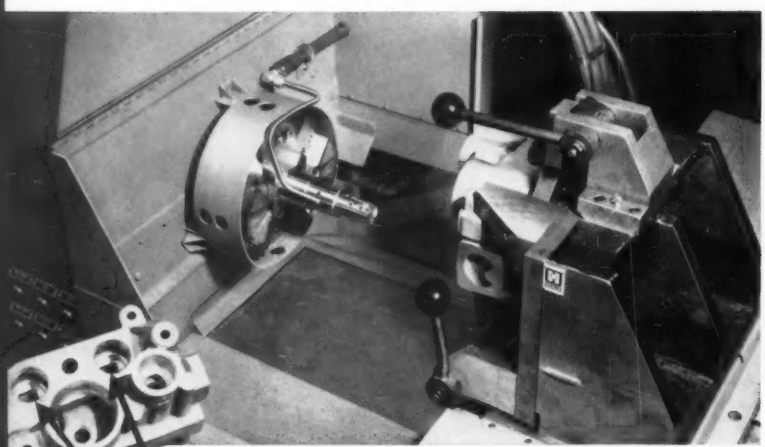
JUNE 1956 – SIXTY-SECOND YEAR

MACHINERY

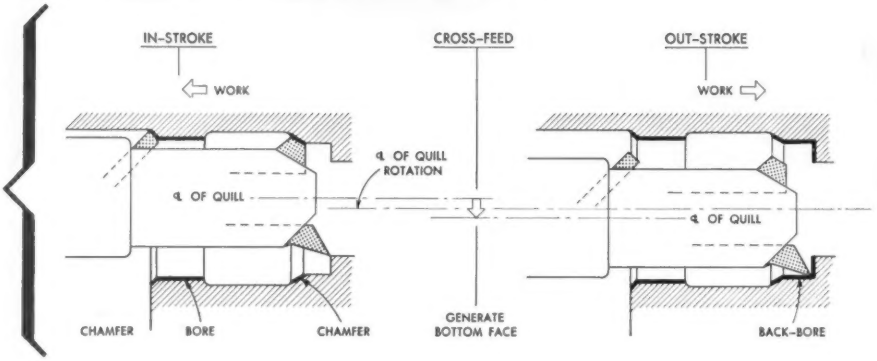
For tool
and work holding
it's
Jacobs
CHUCKS
The Jacobs Manufacturing Company • West Hartford, Connecticut

Heald BORIZING boosts production of aircraft filter bodies

from 8 PARTS PER HR.
to 33 PARTS PER HR.



another example of how a simple Borizing setup can do a better job, faster, and at much lower cost



THE fixture and tooling setup in the photo above looks like a very simple one — and it IS! Yet this single, three-point quill Borizes two chamfers, two I.D.s and a bottom face on each of two identical bores in an aluminum aircraft filter body, all in a single, fully-automatic cycle with only one chucking of the part.

As the diagrams show, the job is done with a cross feed unit on the Borizing quill to present the tooling to the work in the proper sequence. Auto indexing of cross slide positions work for Borizing the two identical bores in sequence.

Compared to the previous method of doing the same job, this Model 221 Bore-Matic increased production from 8 parts to 33 parts per hour, with closer tolerances, better finish, easier operation and less maintenance.

The *simplicity* and *versatility* of Heald Borizing permits important savings on an almost unlimited range of work and finishing operations. Another big reason why it *pays* to come to Heald.

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

HEALD

MACHINERY
Editorial, Advertising, and Circulation Offices
93 Worth St., New York 13, N. Y.

•

Editor
CHARLES O. HERB

•

Managing Editor
CHARLES H. WICK

Associate Editors
FREEMAN C. DUSTON
EDGAR ALTHOLZ
RAYMOND H. SPIOTTA

Materials Editor
PAUL B. SCHUBERT

Shop Mathematics Editor
HENRY H. RYFFEL

•

THE INDUSTRIAL PRESS
Publishers
ROBERT B. LUCHARS
President
EDGAR A. BECKER
Vice-President and Treasurer
HAROLD L. GRAY
Secretary and Publishing Manager

•

Advertising Representatives
WALTER E. ROBINSON
DWIGHT COOK
93 Worth St., New York 13, N. Y.
GEORGE H. BUEHLER
228 N. LaSalle St., Chicago 1, Ill.
NORMAN O. WYNKOOP, Jr.
15937 W. Seven Mile Road
Detroit 35, Mich.
DON HARWAY & COMPANY
1709 W. Eighth St.,
Los Angeles 17, Calif.
RICHARD E. HOIERMAN
2831 El Capitan St., Dallas 28, Tex.

MACHINERY, published monthly by The Industrial Press, Emmett St., Bristol, Conn. Executive offices, 93 Worth St., New York 13, N.Y.

Subscription rates: United States and Canada, one year, $4; two years, $7; three years, $8; foreign countries, one year, $7; two years, $13. Single copies, 50 cents. Changes in address must be received by the tenth of the month to be effective for the next issue. Send old as well as new address. Copyright 1956 by The Industrial Press.

Entered as second-class mail matter May 25, 1953, at the Post Office at Bristol, Conn., under the Act of March 3, 1879. Printed by Hildreth Press, Inc., Bristol, Conn., U.S.A.

British Address
MACHINERY
National House, West St.
Brighton 1, England

French Address
LA MACHINE MODERNE
15, Rue Bleue
Paris-IX*, France

MACHINERY

VOLUME 62 JUNE, 1956 NUMBER 10

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

SHOP PRACTICE

Blades and Razors for the Morning Shave .... *By Edgar Altholz* 141
Exacting Precision Requirements Met by Special Tooling *By Walter McCadden* 148
Diesel Starters Involve Drilling Refinements .. *By Edgar Altholz* 157
Titanium Parts Deep Drawn in One Operation *By J. S. Kirkpatrick* 161
Finishing the Whirlpool Washer ..... *By Dwight Eberly* 166
Know Your Cutting Fluids .... *By R. K. Gould and R. C. Givens* 178
Deep-Hole Tapping of Titanium Alloys ..... *By W. L. Carr* 184
"3-in-1" Plant Makes Standard and Special Electric Motors 186
Improved Alloys Produced by Vacuum Melting 199

MACHINE AND TOOL DESIGN

Impact Extrusion of Aluminum Counter Wheels and Pinions 153
Fundamentals of Electrical Discharge Machining 169
Intermittent Rotation for Instrument Pointers *By George G. Herzl* 189
Double Clutch Permits Reversal of Driven Shaft .. *By J. J. Pot* 190
Mechanism Loops and Twists Wire Ends .. *By Ralph T. Stewart* 190
Lathe and Gaging Fixtures Locate Work from Internal Groove *By W. M. Halliday* 192
Trepanning Tool of Unusual Design ..... *By A. G. Amos* 194
Machine Tools Guided by Magnetic Tape 195

MANAGEMENT PROBLEMS AND EVENTS

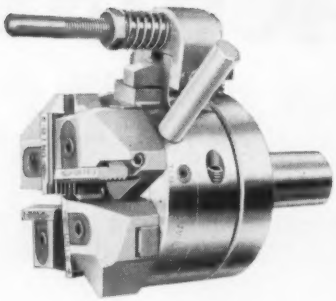
Engineers' Need of Wider Practical Knowledge *By Charles O. Herb* 139
Mergers Affect Markets and Selling ..... *By Bernard Lester* 198
Machine Tool Magic Revealed at Twentieth Electrification Forum 200
Brown & Sharpe Establishes Precision Center 242

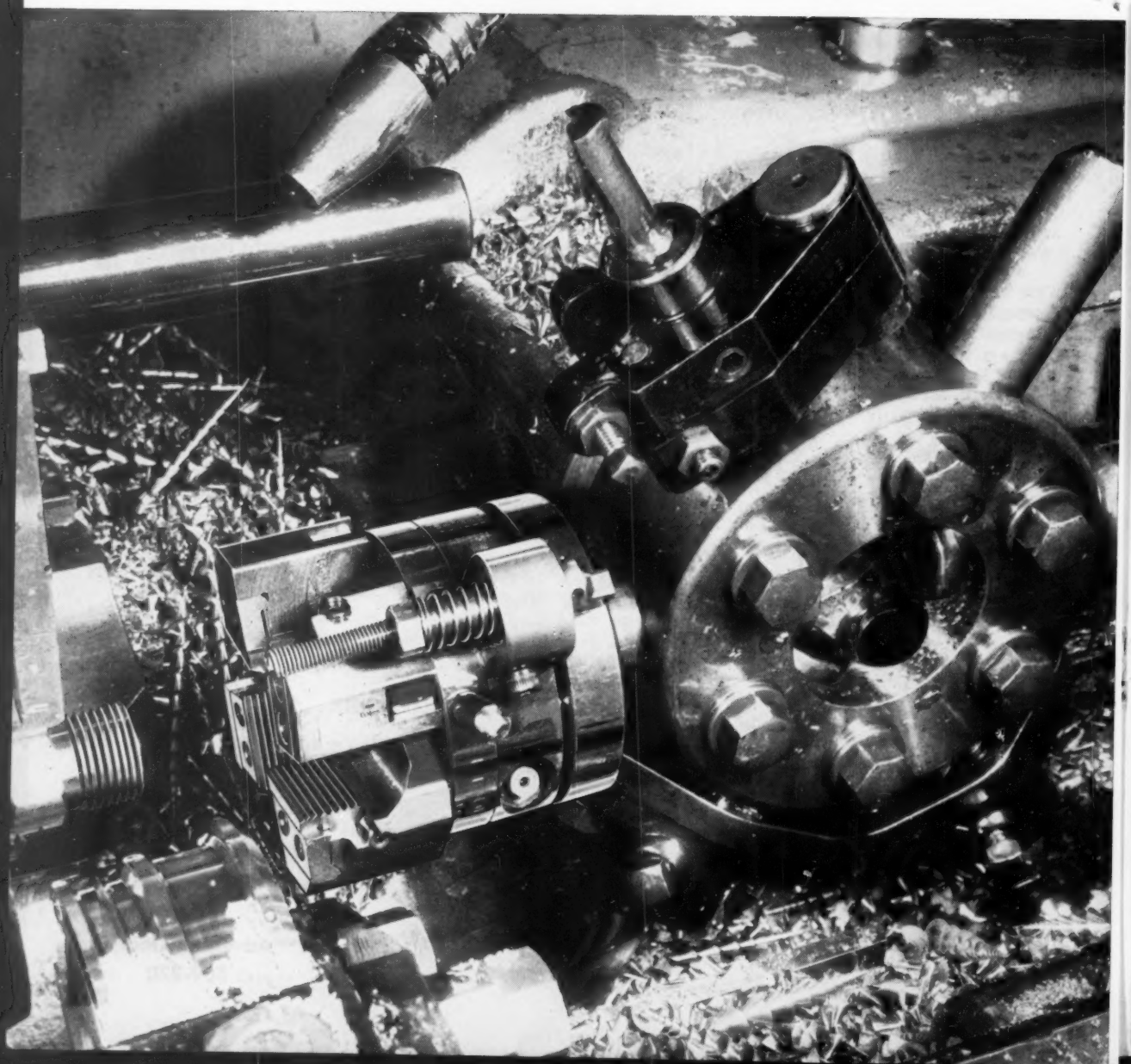
DEPARTMENTS

Keeping Up with Washington 137
Materials of Industry 176
Ingenious Mechanisms 189
Tool Engineering Ideas 192
Problem Clinic 196
Talking with Sales Managers 198
Latest in Shop Equipment .. 202
New Catalogues 229
Between Grinds 244
News of the Industry 246
Data Sheet 249
Coming Events 258

Product Directory
274

Advertisers Index
369-370





LARGE DIAMETER THREADING

on a Brown & Sharpe Automatic

Pol nuts for gas cylinders, requiring both 1⅛" and .880" diameter threads, are threaded at the Fisher Governor Co. (Marshalltown, Iowa) on a B & S Automatic using the 5 EXX LANDMATIC Head.

The 5 EXX LANDMATIC is a compact stationary die head designed for threading operations on small screw machines. It uses tangential chasers and is built in two sizes—the ½" for No. 0 and No. 2 B & S machines with a range from #4 to ½"—and the ⅝" for No. 2 B & S machines with a standard range of #4 to ⅝". The ⅝" model can be equipped with oversize chaser holders, as shown here at Fisher Governor.

The special diameter (.880") threading operation is illustrated with a workpiece of ASTM-B16-Brass (65-80 Rockwell B). A 14 pitch UN thread has just been cut $^{17}/_{32}$" long to within .140" of the shoulder (held to .0036" on the pitch diameter). Threading at 450 RPM, approximately 150,000 pieces are completed between chaser grinds. This same head, with proper chasers and chaser holders, is used to produce 1⅛" diameter 16 pitch threads $^{13}/_{16}$" long.

The EXX Head features an adjustable spring mechanism which allows compensation of cam feed lead for threads of different pitches. Through this device the die head can be adjusted for the correct amount of pressure for the pitch of the thread to be cut. Another important feature is the external tripping mechanism which prevents premature head opening due to rapid turret indexing. These EXX Heads also offer important economies through the use of LANDIS Tangential Chasers: minimum tool inventory—the same chasers will thread all diameters of the same pitch and form; low tool cost—chasers are usable for 80% of their original length, and can be replaced or reground singly as required.

For detailed information and specifications on the EXX or other LANDIS Die Heads please ask for Bulletins F-80 and F-90.

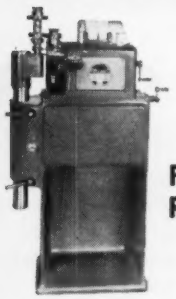
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT - CUTTING - TAPPING - GRINDING - ROLLING

LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA • U. S. A.

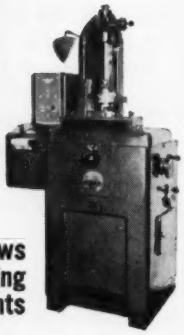
458C

WORTH THEIR



Fellows
Red Liners

Fellows
Lead Measuring
Instruments



Fellows
Involute Measuring
Instruments

THE
PRECISION
LINE

WEIGHT IN PROFITS

Fellows Gear Inspection Instruments with Chart Recorded Proof of Gear Accuracy

Deviations of the "red line" on a chart from a Fellows Gear Inspection Instrument, not only warn of costly gear errors—but indicate the nature of that error. Proper adjustments can thus be made immediately before expensive rejects accumulate in long production runs.

The use of Fellows Gear Inspection Instruments to continually "spot check" gears keeps waste of time, labor and materials to a minimum... provides undeniable chart recorded proof of gear accuracy... guarantees superior performance for the life of your product.

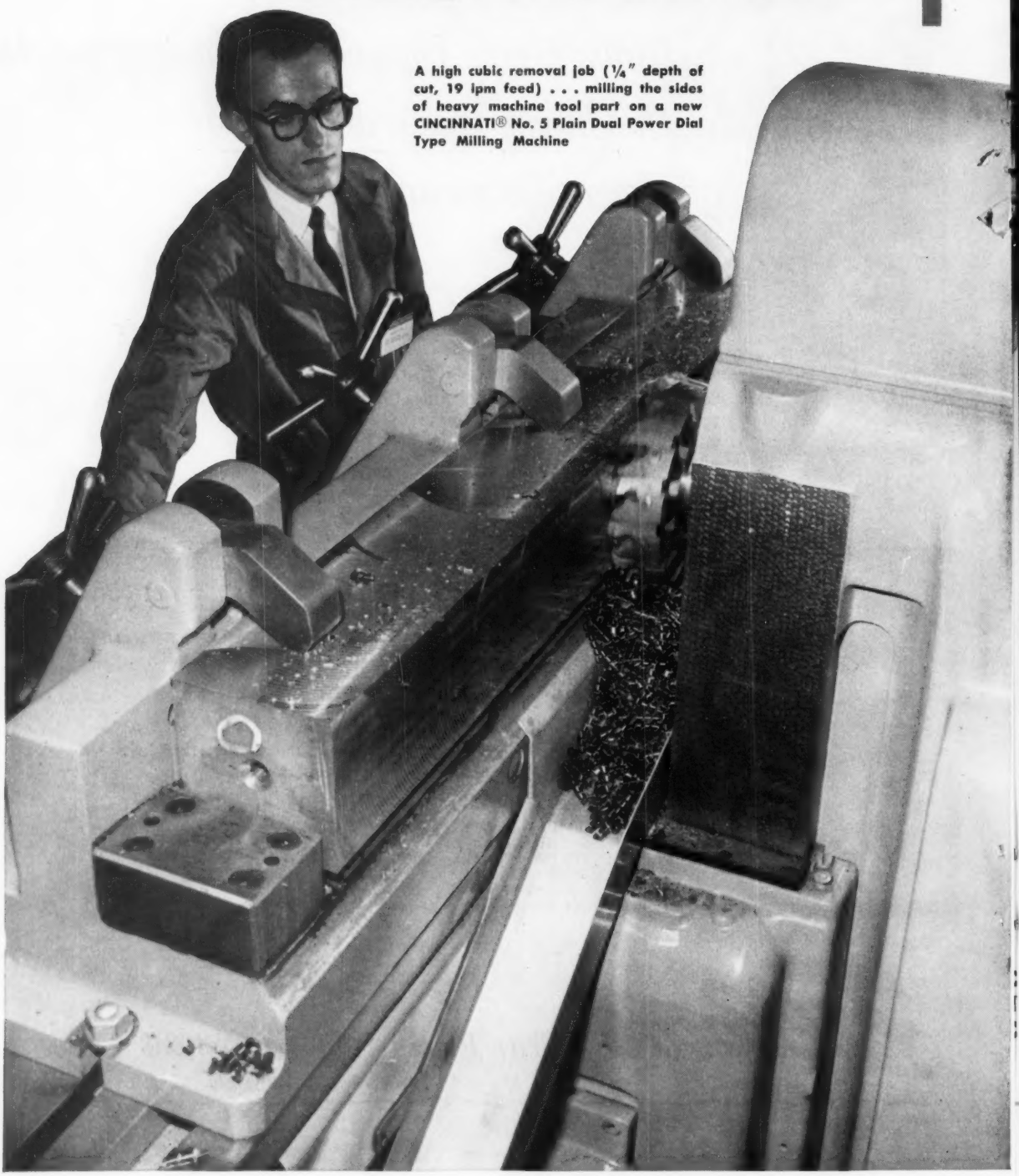
- **For composite check,** FELLOWS RED LINERS record gear errors in combination on a chart as the precision master rotates in intimate contact with the gear being checked. 3 models to 18" p.d.
- **For checking lead,** FELLOWS LEAD MEASURING INSTRUMENTS check various leads—also crown and taper. No involved calculations required. Errors charted by an electronic recorder at 500 to 1 magnification. 12", 24" p.d. models.
- **For checking involute profiles,** FELLOWS INVOLUTE MEASURING INSTRUMENTS check accuracy of involute profiles—also location of involute modifications. Electronically provide charts at 500 to 1 magnification. 12", 24" p.d. models.

There's a Representative in any Fellows office who will be glad to show you how to operate Fellows Inspection Equipment... and just how, in your operation—Fellows Gear Inspection Instruments can be "worth their weight in profit".

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 319 Fisher Building, Detroit 2
5835 West North Avenue, Chicago 39
2206 Empire State Building, New York 1
6214 West Manchester Avenue, Los Angeles 45

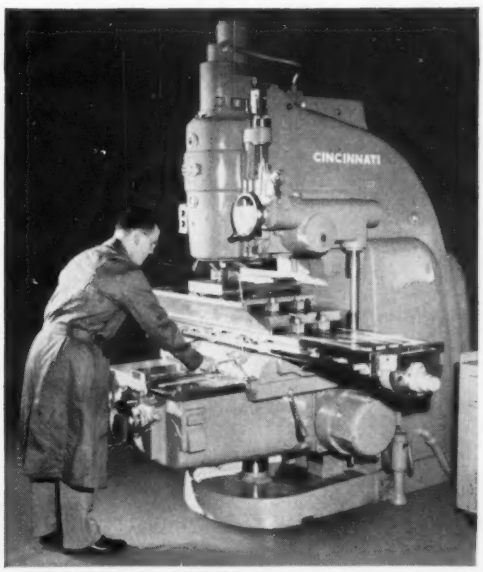
Fellows *Gear Production Equipment*

For Quickest Action in Cutting Metal and Costs

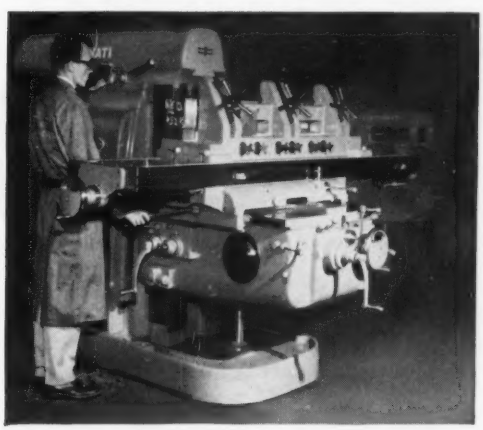


A high cubic removal job (¼" depth of cut, 19 ipm feed) . . . milling the sides of heavy machine tool part on a new CINCINNATI® No. 5 Plain Dual Power Dial Type Milling Machine

NEW CINCINNATI HIGH POWER and DUAL POWER DIAL TYPE MILLING MACHINES



Power draw-bar attachment reduces the cost of this 12-operation job on No. 4 Vertical Machine



Front view of the setup shown at the left

Primarily, you're cutting costs when you step up cubic removal of metal. And you have plenty of opportunity to remove metal as rapidly as the work and fixture will permit when you assign the job to a new CINCINNATI® High Power or Dual Power Dial Type Milling Machine. These new knee types are tops in cutting capacity; tops in easy, convenient operator control; tops in low maintenance expenses. You'll be interested in the "vital statistics."

Sizes	No. 3	No. 4	No. 5	No. 6
Styles	Plain Univ. Vert.	Plain Univ. Vert.	Plain *Univ. Vert.	Plain Vert.
Table travel	34"	42"	50"	60"
24 Spindle speeds	16 to 1600 rpm	14 to 1400 rpm	14 to 1400 rpm	14 to 1400 rpm
32 Feeds	⅜ to 90 ipm	⅜ to 90 ipm	⅜ to 90 ipm	⅜ to 90 ipm
Motor drives:				
Spindle (H.P.)	20 hp	25 hp	25 hp	25 hp
(D.P.)	30 hp	50 hp	50 hp	50 hp

**No. 5 Universal available in High Power Machine only*

Columns of figures are dry reading; more interesting are the cost-reducing possibilities of the many High Power and Dual Power features. For example, horizontal machines are equipped with Dynapoise overarms to reduce self-excited chatter . . . plain and vertical machines are equipped with automatic table cycles . . . full power to the spindle with independent feed drive motor . . . single lever, power selection of speeds and feeds. Many additional features and advantages are outlined in new catalog No. M-1917. Write for a copy; or look in Sweet's for brief data.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

For more information fill in page number on Inquiry Card, on page 229

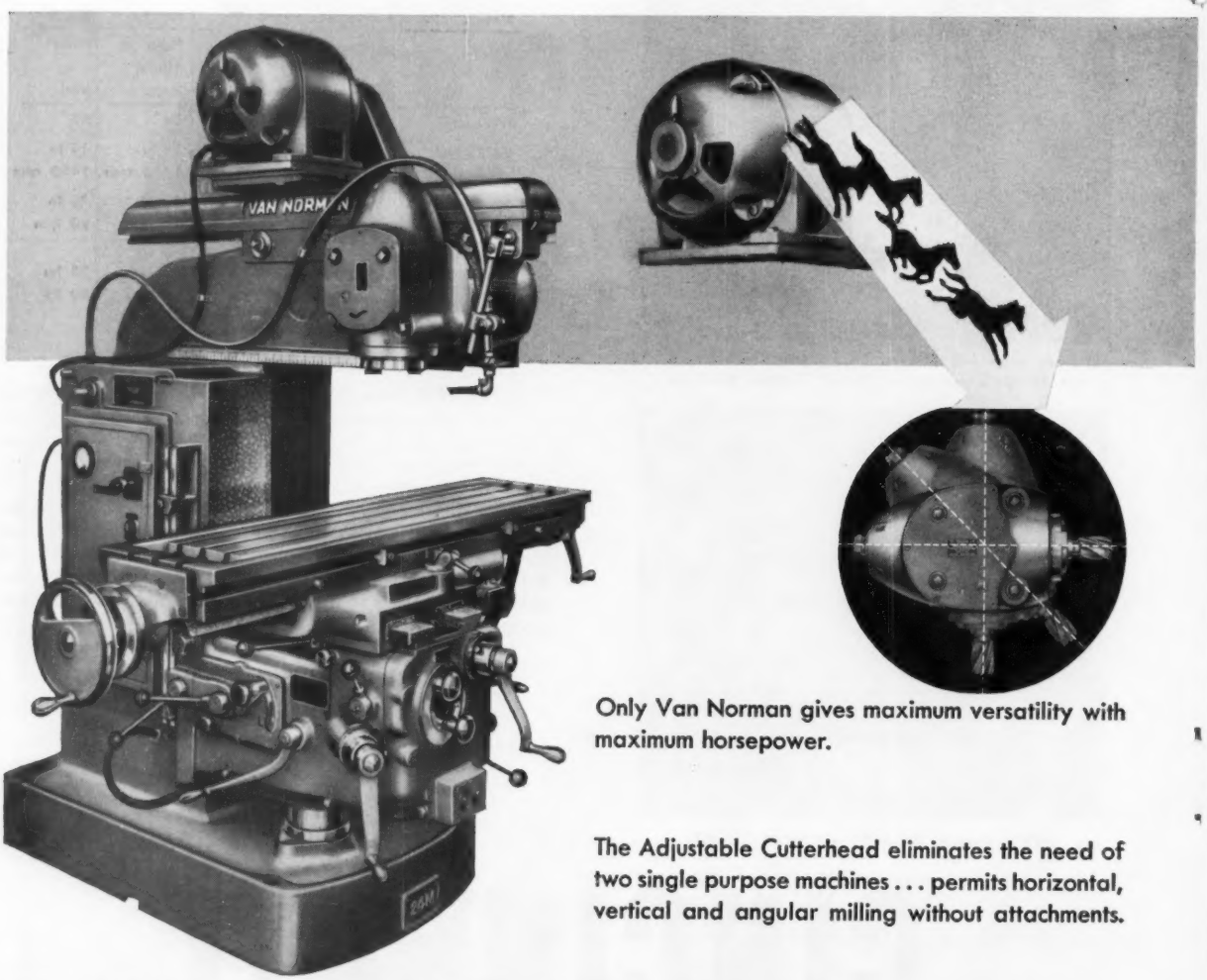
Here's a Profitable Equation:

1 Van Norman Ram Type Miller

RESULT

LESS Capital Investment

MORE Machine Productivity



Only Van Norman gives maximum versatility with maximum horsepower.

The Adjustable Cutterhead eliminates the need of two single purpose machines . . . permits horizontal, vertical and angular milling without attachments.

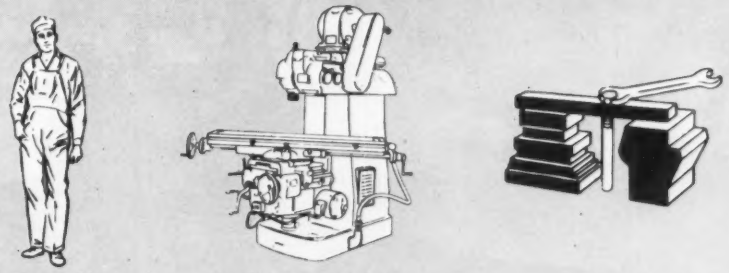
VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

=2 Single Purpose Machines

Which would you rather have?

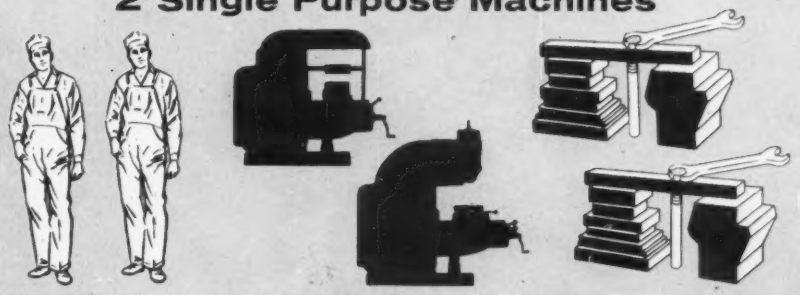
1 Van Norman Ram Type Miller



1 Operator | 1 Machine | 1 Complete Setup

or

2 Single Purpose Machines



2 Operators | 2 Machines | 2 Complete Setups

You can own a Van Norman Ram Type Milling Machine for as little as $.81 per day per $1000. investment.

Write for catalog and purchase plans giving complete details on all Van Norman Ram Type Millers.

Don't wait . . . for extra profits install a Van Norman now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to 5 years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

Lease and Conditional Sales Contracts not available to Export.

COMPANY | **SPRINGFIELD 7, MASSACHUSETTS**

For more information fill in page number on Inquiry Card, on page 229

Landis microsphere bearings speed

Exclusive Landis microsphere bearings on <u>both</u> grinding and regulating wheels

Landis No. 12 Centerless Grinder

LANDIS

precision grinders

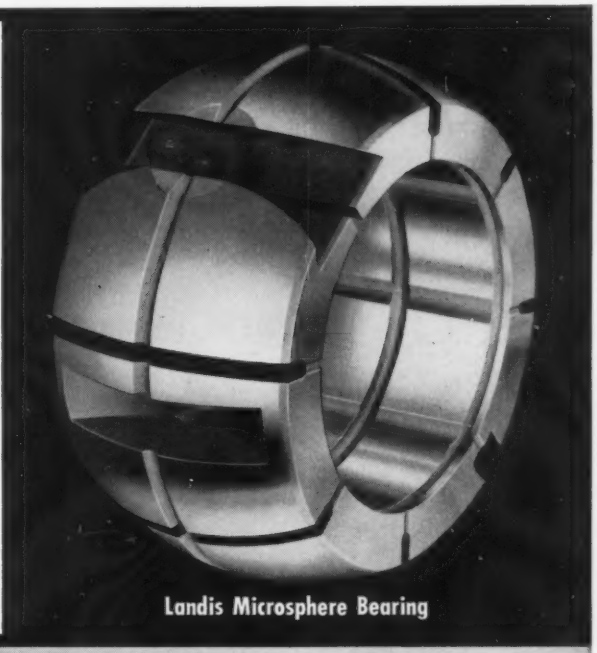
centerless production... lower costs

Quick, positive sparkout
... for faster grinding cycles

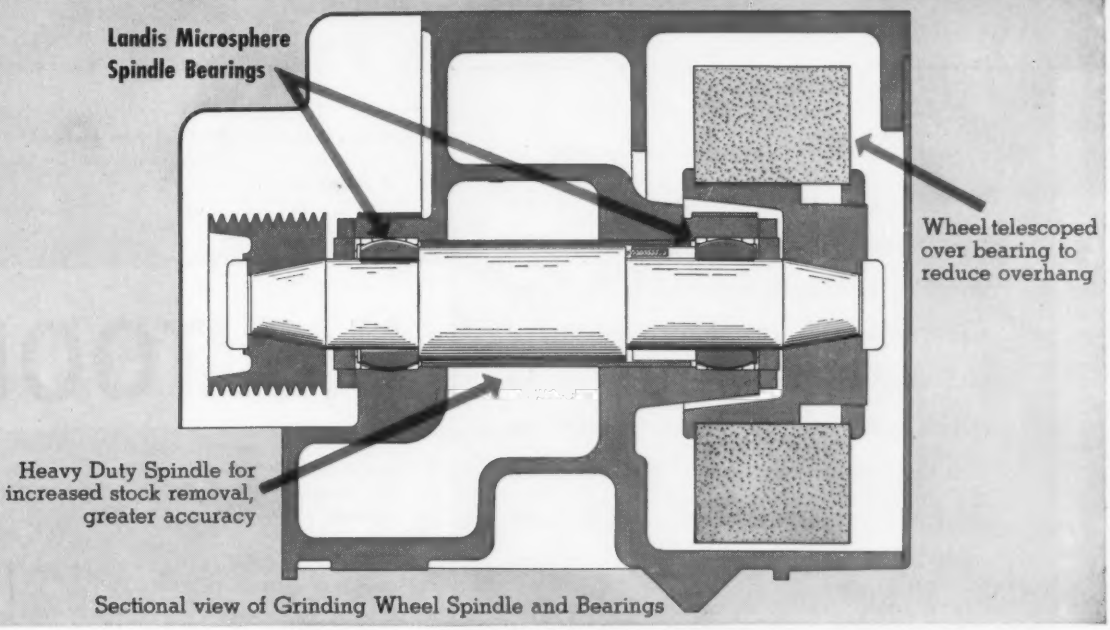
Close running clearance
... for fine finishes

Simple, one-piece construction
... trouble-free operation

Increased rigidity
... heavier cuts to closer tolerances



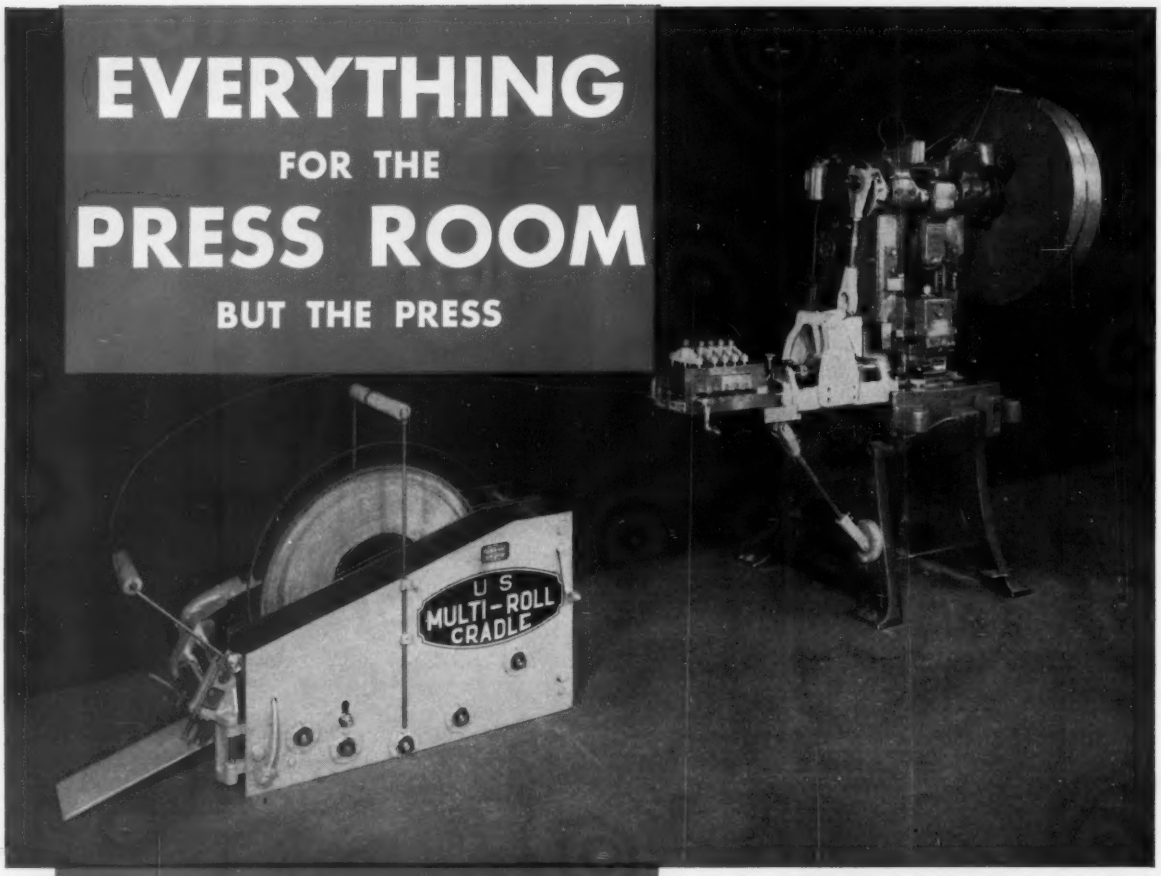
Landis Microsphere Bearing



Sectional view of Grinding Wheel Spindle and Bearings

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

EVERYTHING
FOR THE
PRESS ROOM
BUT THE PRESS



If you are interested in reducing costs in your Press Room, U. S. equipment of the type illustrated may be the answer. The units included in the line of U. S. Automatic Press Room Equipment are designed and built with the aim of converting the punch press into an automatic machine. The end results are increased production, reduced scrap, reduced operator fatigue, reduced material handling and overall reduced costs. This is the goal of all manufacturing concerns. If you use presses in your production process, ask for a copy of Bulletins 80-M and 95-M.

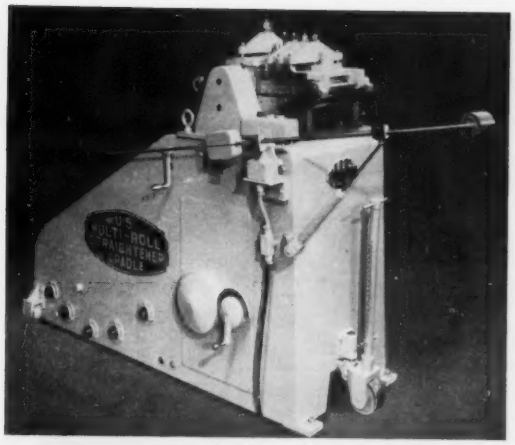
Above: Conventional OBI Punch Press equipped with U. S. Slide Feed with Plain Straightener and U. S. Multi-Roll Cradle.

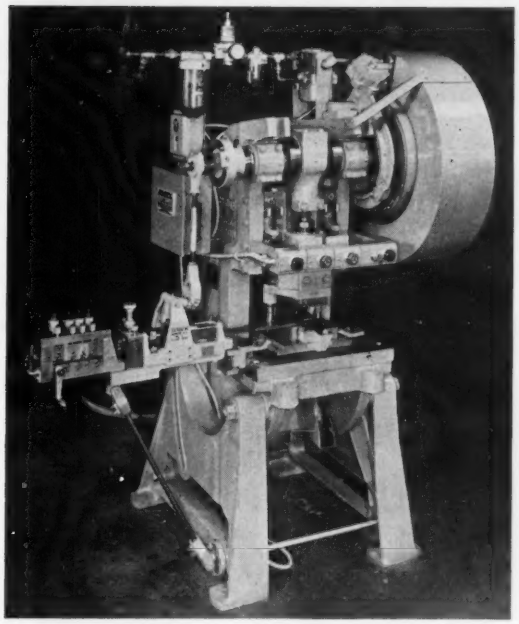
U.S. TOOL

Above right: Model PDSC-940 U. S. Combination Coil Cradle and Power Driven Straightener suitable for material up to 9" in width and coils with O. D. up to 40", weight capacity 1,500 lbs.

Right center: Another OBI Press equipped with U. S. Slide Feed and Plain Straightener.

Right below: U. S. Air Operated Slide Feed (no mechanical connections to the press), open side type, suitable for material up to 15" in width and feeding length adjustable up to a maximum of 12" at one stroke. Longer feed lengths obtainable by cycle feeding with counter.





U. S. SLIDE FEEDS

Mechanically-Driven U. S. Slide Feeds made in a range of sizes up to 24" wide.

U. S. ROLL FEEDS

Made in either single or double types in a range of sizes.

U. S. STOCK STRAIGHTENERS

Made in a range of sizes in both the Plain and Power Driven Types.

U. S. COIL CRADLES

Made in a range of standard sizes up to 24" in width; larger units quoted upon request.

U. S. STOCK REELS

Range of sizes made in Plain, Automatic and Centralizing Types.

U. S. STOCK OILERS AND WIPERS

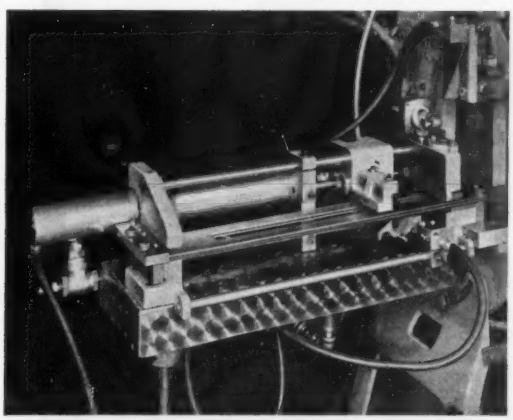
Presently made in three sizes; 8, 12 and 24" width capacity.

U. S. SCRAP CHOPPERS

Made in one size independently Motor-Driven and also Ram or Eccentric-Operated Types for use with Roll Feed setups.

COMPANY, Inc.

AMPERE (East Orange)
NEW JERSEY



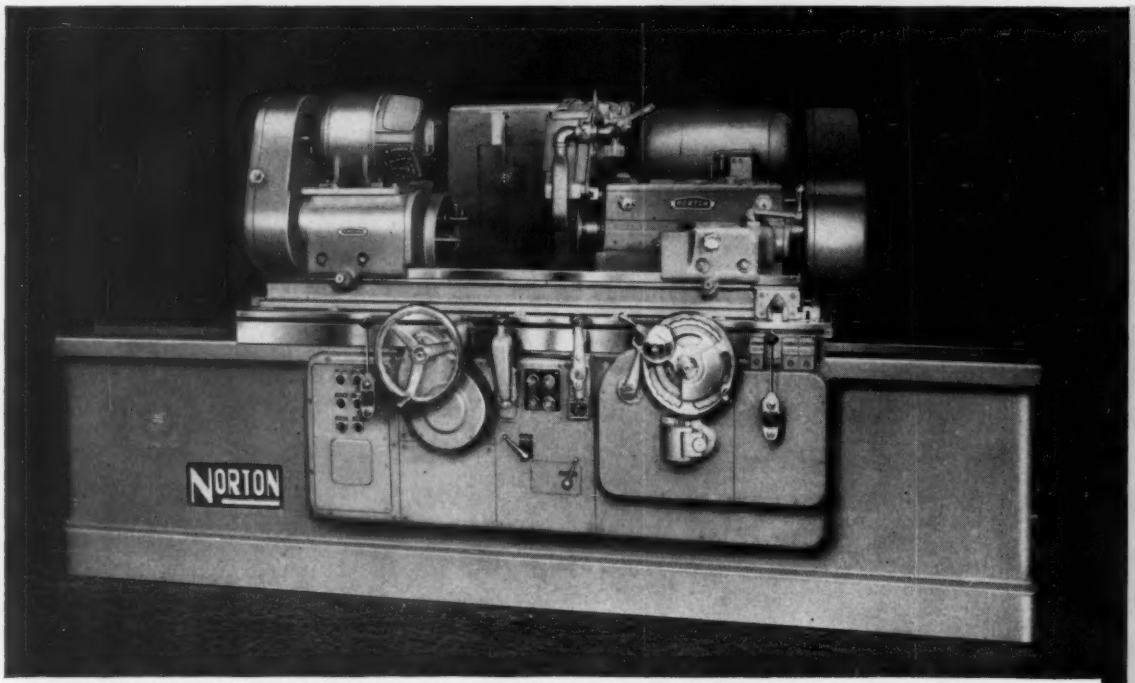
Also U. S. MULTI-SLIDES

For the automatic high-speed production of precision formed stampings from coil stock, your attention is called to the U. S. Multi-Slide Machine as described and illustrated in Bulletin No. 15-M.

U. S. MULTI-MILLERS

Production horizontal type Milling Machines for the performance of a wide range of milling operations on small and medium sized parts described in Bulletin No. 25-M.

For more information fill in page number on Inquiry Card, on page 229



A NORTON TYPE CTU SEMIAUTOMATIC CYLINDRICAL GRINDER. The fastest, most economical and versatile grinding machine of its type. One-lever control of the automatic grinding cycle reduces the operator's duties to loading and unloading. Both the 6″ and 10″ Type CTU's are available as semiautomatics or as plain machines.

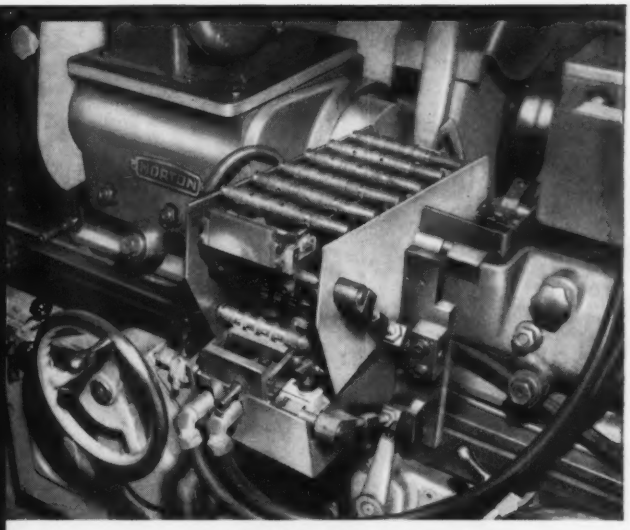
Norton Type CTU Cylindrical Grinders are packed with features for...

Production line and job shop users report that Norton 6″ and 10″ Type CTU cylindrical grinders have doubled and tripled production, replaced several machines and eliminated costly extra operations.

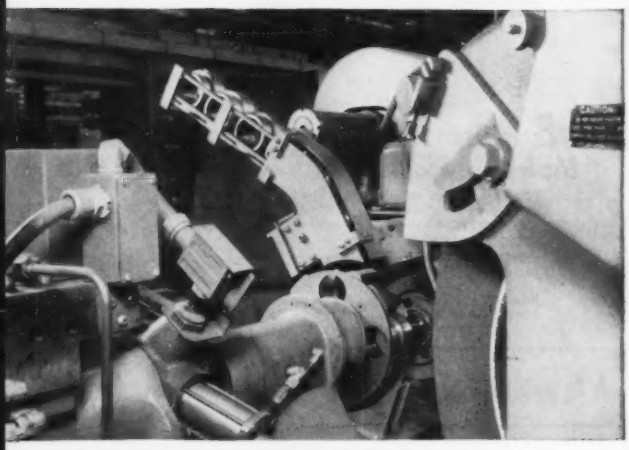
That's because of the many time-and-work-saving "Touch of Gold" features — standard and auxiliary — available with these grinders.

Some of the expertly automated auxiliary features are described here. Check them carefully — and figure their value to your own cylindrical grinding operations. And remember: only Norton offers you such long experience in both grinding machines and wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. For further facts, see your Norton Representative, or write to NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

THE SWIVALIGN* ELIMINATES CUT-AND-TRY. Another Norton "Touch of Gold" development for faster, better, lower cost grinding. The SWIVALIGN Dual Electric Indicator, available for Norton cylindrical and universal grinders, enables operators to adjust the angular positions of swivel tables quickly and accurately, eliminating the usual cut-and-try guesswork. Featuring positive response and easy operation, this accurate instrument saves grinding time and money.

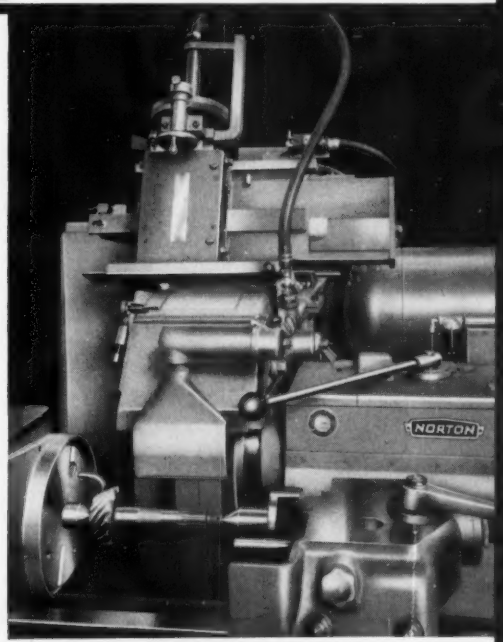


RAIL TYPE



TURRET TYPE

YOUR CHOICE OF AUTOMATIC LOADING DEVICES. Two types of Norton automatic loading devices are obtainable with 6" and 10" Type CTU semiautomatic grinders. The rail type loader is designed to handle a variety of small shafts. The turret type loader handles workpieces which must be chucked. Thanks to their steadily paced, automatic operation these Norton-developed loading mechanisms can be adapted to full automation. Or, they make it possible for one operator to tend a battery of machines, speeding production and cutting unit costs day after day.



WHEEL HEAD MOUNTED AUTOMATIC TRUING OFFERS BIG ADVANTAGES. A Norton automatic truing device, as shown here on a Type CTU grinder, quickly repays its original cost. It speeds up production, increases wheel life and increases diamond life. Also, it decreases the skill and effort required with hand truing. Operation is extremely simple. Once the original settings are made, all you do is push a button. Then the diamond automatically makes its round trip across the wheel face, at pre-determined speed and feed. Easy adjustments assure correct settings for each job . . . Another step forward in automatic grinding!

NORTON

GRINDERS and LAPPERS

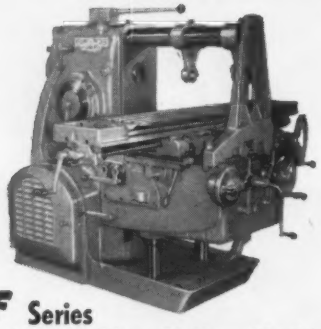
Making better products . . . to make your products better

District Offices: Worcester • Hartford • New York Area, Teterboro, New Jersey • Cleveland • Chicago • Detroit

*SWIVALIGN — Norton trade name for Dual Electric Indicator for accurate measurements of swivel table adjustment.

Backbone for any job...

New Kearney & Trecker TF Series milling machines have it . . . backbone for the precise tool room job and "plenty of beef" for rugged duty milling



TF Series
Model 210 Plain Milling Machine

POWER — 10hp spindle drive; 3hp feed and rapid traverse drive
TABLE WORKING SURFACE — 62" x 14"
FEEDS — (32) ⅜ to 90 ipm
SPEEDS — (24) 15 to 1500 rpm
WEIGHT — 9200 lbs.

New TF Series milling machines are available under Tool-Lease program

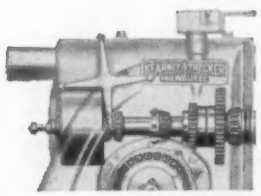
THE solid-back column is an outstanding example of Kearney & Trecker advanced engineering. This one-piece, cross-ribbed, solid-back column is the most important single element of the machine. Every inch of metal is scientifically distributed to add rigidity where it's needed the most. Thus the column readily absorbs all the heavy work loads supported by the heavier, wider knee, and also all torsional thrusts to the cutter transmitted through the heavy-duty, three-bearing spindle and double overarms.

What's more, the heavier column base is specially designed for the new, exclusive twin screw knee support — the only balanced-design arrangement offered today.

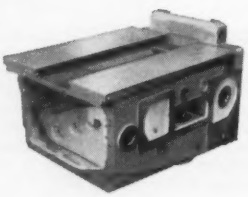
In addition, the new TF's give you other outstanding design and operating features, never before available on any knee-type milling machines. They're built in five sizes — No. 2 to No. 6 from 10hp to 50hp in Plain, Universal and Vertical styles.

For facts and figures that will help you — ask about TF's — the latest in milling machines. Contact your Kearney & Trecker representative — call him or mail coupon direct to factory today.

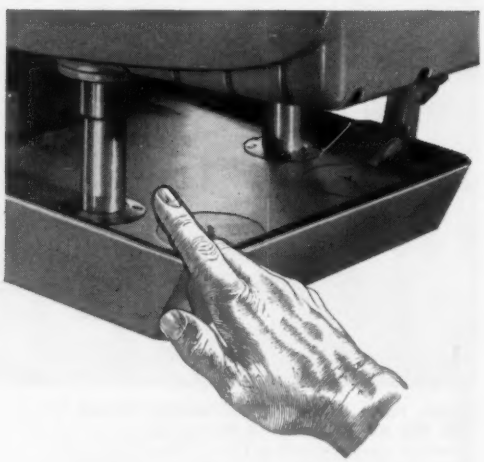
A few more of many reasons why TF Series milling machines are way out front in rigidity



Three-Bearing Spindle — Complete assembly consists of three heavy-duty bearings, flywheel, train of wide-faced forged steel gears. Rigidity of spindle unit contributes to increased cutter life . . . excellent finish . . . quieter and vibrationless operation.



Heavier, Wider, One-Piece Knee — The *twin screw* arrangement supports the heavier, larger knee. Span and length of ways are increased considerably, providing fuller saddle support . . . long-lasting accuracy.



Twin Screw Knee Support — Exclusive double-support arrangement most effectively distributes weight of new machines' much larger, wider, heavier knee, saddle and table. This balanced design substantially increases stability under heaviest loads . . . offers greater resistance to torsional thrust under all cuts . . . halves the wear factor, assuring greater, longer-lasting accuracy.

KEARNEY & TRECKER CORP.
6788 W. National Ave., Milwaukee 14, Wisconsin

Please send me Catalog No. TF-50 with details on the new line of TF Series Plain, Universal and Vertical milling machines.

Name.....

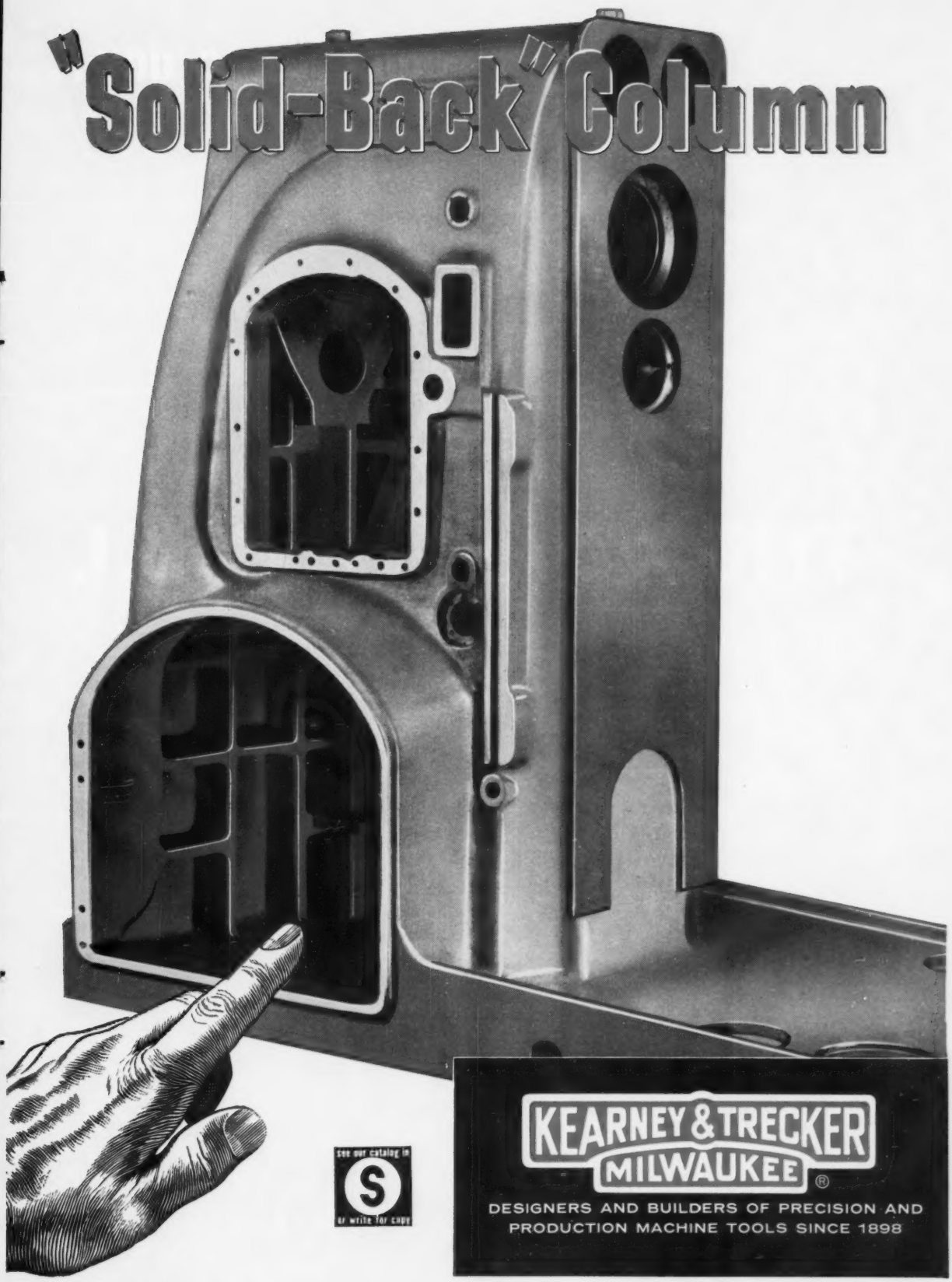
Title.....

Company.....

Address.....

City.....Zone.....State.....

"Solid-Back" Column



see our catalog in S or write for copy

KEARNEY & TRECKER MILWAUKEE®

DESIGNERS AND BUILDERS OF PRECISION AND PRODUCTION MACHINE TOOLS SINCE 1898

don't lose a day...

THE *HOTTEST* O.B.I.

without the spectacular facts

TOTALLY ENCLOSED . . .
BRAND NEW FROM THE GROUND UP

- Rugged, front-to-back crankshaft with huge crankpin
- Fully concealed, yet accessible, driving mechanism
- Enclosed, rigidly supported gearing operates in sealed oil bath
- Electro-pneumatic friction clutch on crankshaft
- Wider spaced, longer, narrower gibs
- Wider, box type slide all within gibbing
- Precision, hardened, longer-wearing gears
- Compact, straight-line, space-saving, all-steel frame

This is it! The most talked about press in the world! The press that captured the hearts of the entire industry at the Machine Tool Show! The press that was born to do more than any O.B.I. ever built!

Get the spectacular facts and figures on this metalworking marvel . . . the all-new Niagara Series E, Front-to-Back Crankshaft Inclinable. It outmodes everything within its range (75 to 200-ton capacities, 4 ½ to 7 ½ inch shaft diameters, standard and automated models).

PRESS IN HISTORY!

STUDDED WITH SCORES OF
TECHNICAL IMPROVEMENTS

- No overhanging gears, flywheel and other mechanisms
- No damaging crankshaft deflection
- Full support to wide dies — no overhang on slide
- Greater resistance to off-center loading
- Accurate alignment of slide, with minimized tendency to cock
- Substantially increased die life
- Smoother, safer press performance — simpler, thriftier servicing
- Less floorspace required

just send this...

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N.Y.

Please rush new Bulletin 56 with all the facts on your brand new Series E Inclinable.

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

mm

to get this...

26 FACT-FILLED PAGES

NIAGARA

front-to-back crankshaft
INCLINABLE PRESSES

America's Most Complete Line of Presses, Shears, Press Brakes, Other Machines and Tools for Plate and Sheet Metal Work.

For...

General-Purpose Sawing

with

High Speed

Accuracy, Economy

Model 4B/M2/E2
Equipped with standard
work track
(Optional Equipment).

MARVEL No. 4B

HIGH SPEED HACK SAW

Exclusive features

1. Horizontal Ball Bearing Saw Frame.
2. Screw Feed—Automatic or Hand Operated.
3. Quick Return Stroke—allows greater number of strokes per minute.
4. Simple Positive Coolant System.
5. Adjustable Stroke—can be shortened for larger capacity.
6. Speed Range—available in 1, 2 or 4 speed models for wider range of work.

Let us prove to you the many reasons why this MARVEL Hack Saw offers the cheapest, most accurate and fastest "cut-off" method available to you at a low initial cost.

Ask your dealer, or write us for Bulletin GP35 which fully describes and illustrates the many exclusive features which makes this Hack Saw Machine your "best buy".

Metal Cutting

MARVEL SAWS

Better Machines–Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Avenue • CHICAGO 39, ILL.

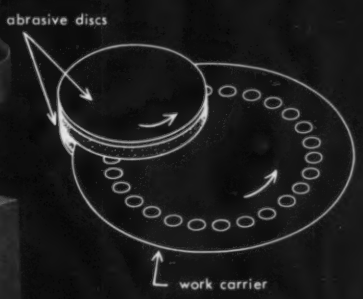
For more information fill in page number on Inquiry Card, on page 229

Improved Gardner vertical double disc grinder ...for high production, low cost flat surfacing

grinds **TWO** parallel surfaces in **ONE** operation

typical operation

WORKPIECE	Ceramic switch stators
PRODUCTION	1200 per hour
STOCK REMOVAL	.010" to .016"
TOLERANCES	.002" flatness .002" parallelism .004" uniformity

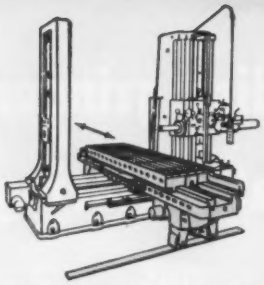


Gardner 2V18
Vertical Spindle Disc Grinder

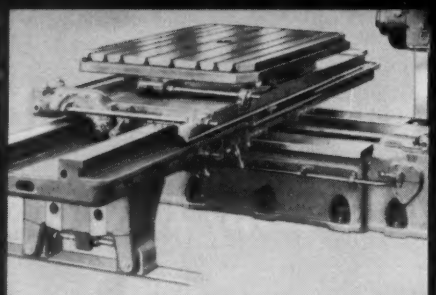
GARDNER

precision disc grinders

BELOIT, WISCONSIN

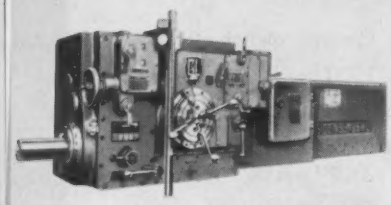


Increased table sizes, extended saddles, saddle supports and auxiliary runways — foundations in-the-floor or over-the-floor types.

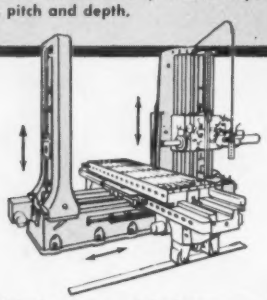


Built-in rotary tables with power milling feeds available with round, square or rectangular platens in various sizes.

Auxiliary combination plain and hand feed rotary tables available with round, square or rectangular platens in various sizes.



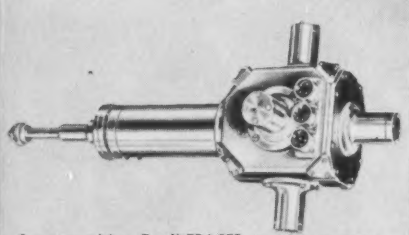
Built-in thread lead device permits cutting of precision threads to any standard prescribed form, pitch and depth.



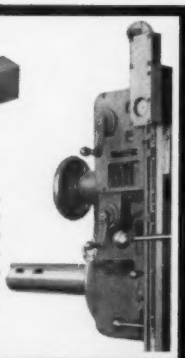
Full ribbed column and bed assures maximum rigidity. Machines available in various increased column and end support heights plus increased bed lengths.

Giddings & Lewis 30 Series table-type machines give you more optional arrangements . . . more accessories . . . more attachments than any other horizontal bar in the world!

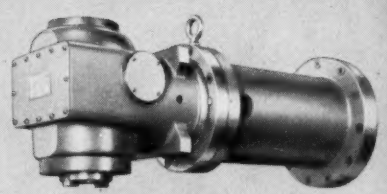
• For complete specifications on G&L 30 Series Table-Type Horizontal Boring, Drilling and Milling machines ask for Bulletin No. 345.



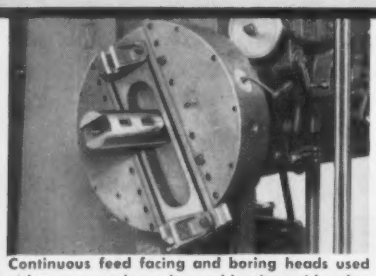
Super-sensitive Dupli-TRACER assures accurate 2- or 3-dimensional stepless contour tracing and 360° profiling. Another important feature is a manual steering control.



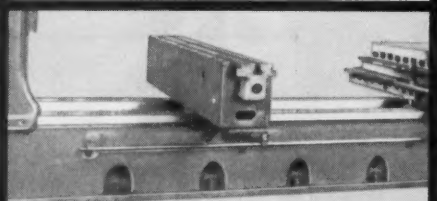
Automatic, electrically-operated positioning device for both headstock and table travel assures accurate machine settings repetitive to .0002" . . . eliminates time-consuming fine hand adjustments.



Heavy-duty, single-spindle, angular milling attachment operates at right angles to machine spindle. Offers unusual flexibility for machining hard-to-reach surfaces.

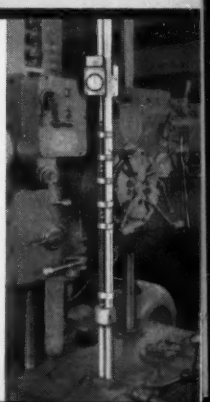


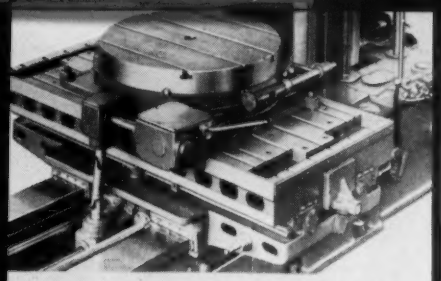
Continuous feed facing and boring heads used either separately or in combination with other attachments or accessories for turning, facing, threading, back facing, grooving, etc. Telescopic, right angle and facing tool holders, and high speed grinder are also available.



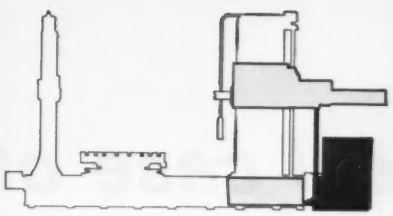
Plain or sliding platen auxiliary tables, mounted between table and end support, add extra rigidity in machining long workpieces which overhang the width of table.

Improved measure device, used in conjunction with precison end measure rods (complete sets or individual units) is employed where extreme accuracy is required — readings to .0001". Device includes vertical and horizontal measuring unit to indicate vertical travel of headstock . . . cross travel of table on saddle . . . also for transverse saddle movement.

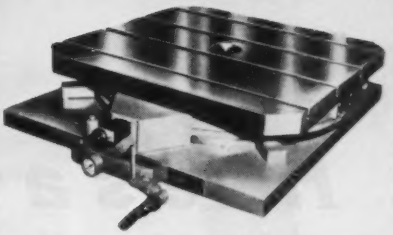




Auxiliary combination plain, hand and power take-off feed rotary tables available with round, square and rectangular platens in various sizes.



The exclusive G&L "Lubri-Cool" system, shown connected to headstock and milling feed unit, assures machining accuracy under heavy loads and in ambient temperatures.



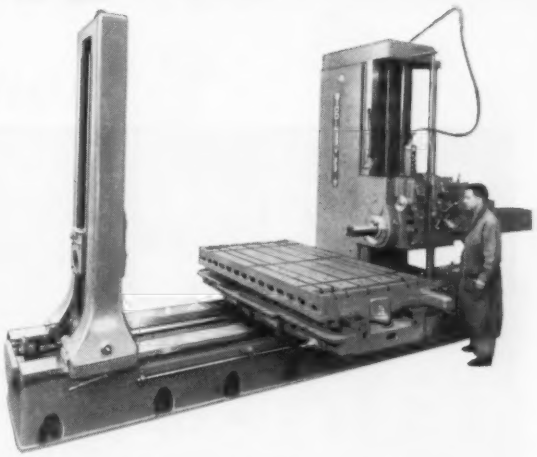
New G&L Air-Lift rotary table literally "floats on air." Capable of 360° indexing off center loads . . . eliminates multiple setups. Available with round, square or rectangular platens.

Here's why the world's favorite, profit-making Horizontal Boring, Drilling and Milling machines are Giddings & Lewis 30 Series, table-types — Model 340-T with 4" dia. spindle (20-hp motor) and Model 350-T with 5" dia. spindle (25-hp motor). It's because of their ability to be adapted to handle an extremely broad range of work when equipped with any of a big variety of optional equipment, attachments and accessories.

Year in and year out these machines continue to offer you more new features — such as the exclusive "Lubri-Cool" system. You'll discover too, that no other machine on the market today offers you so many distinct performance and capacity boosting features for boring, drilling and milling.

Yes, there's no better time than now to find out how much more work these machines can do in your shop. Contact your Giddings & Lewis representative today. He'll be glad to give you all the facts.

G-58

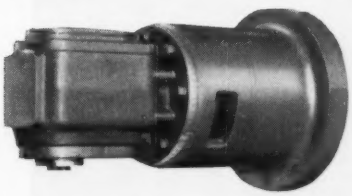


G & L *and* HYPRO DIVISION

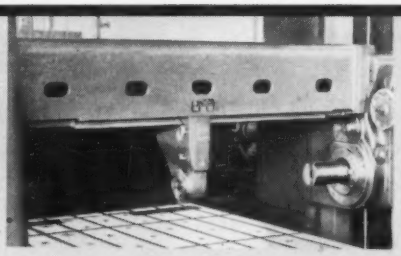
GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

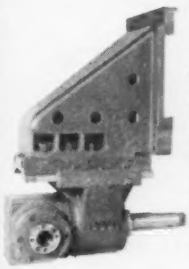
Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines—table, floor and planer types; HYPRO Double Housing and Open Side Planers, Planer Type Milling Machines and Vertical Boring Mills; Vertical Turret Lathes; Spar and Skin Milling Machines, and VARIAX machines.



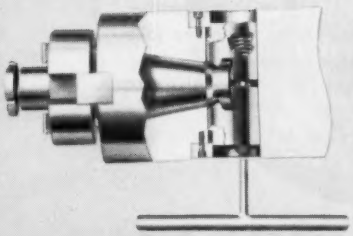
Heavy-duty, two-spindle angular milling attachment handles heavy cuts with high power outer spindle. Medium-duty inner spindle used for a wide range of drilling, boring, light milling and other work.



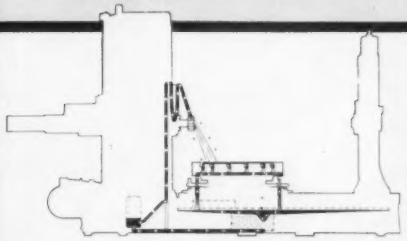
Cross-rail type arbor support in various lengths permits setting of milling cutters at any position over the table. It's ideal for slab, gang and straddle milling operation.



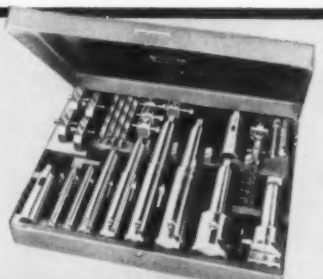
Right angle, heavy-duty sliding-head angular milling attachment with adjustable overarm support is practical for heavy milling, boring, drilling, reaming, etc. Medium-duty unit also available for machining at any angle in large openings and cavities.



Optional Quick-Change or Morse taper spindles available. Quick-Change spindle positively retains or ejects cutting tools by means of a simple wrench adjustment.



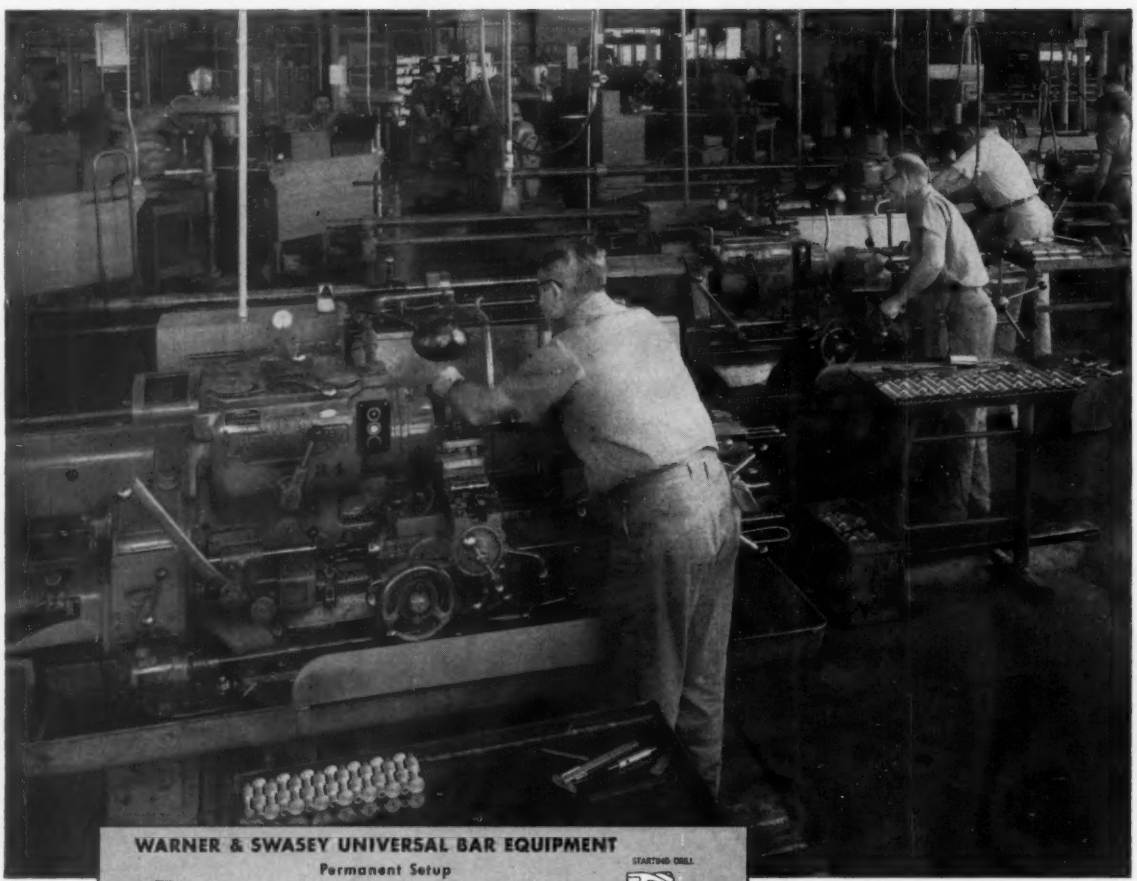
High volume coolant system on 30 Series machines assures an adequate supply of coolant to cutting tool. Table tee-slots are closed at the ends . . . table and saddle drilled allowing coolant to pass into a trough attached to bed of machine. Coolant tank is cast in the bed, or optional tank may be installed in floor.

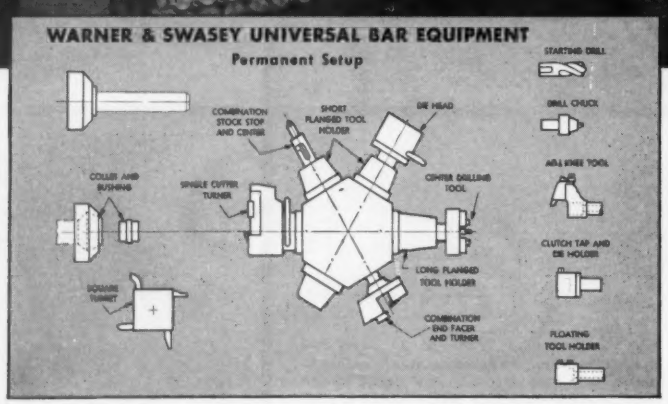


Davis Super Micrometer Stub Boring Tools, available in complete sets, speed boring in production and tool room work. Line bars with block type or micrometer expansion tools also available.

Here's a real case of

SMALL LOT





Warner & Swasey Standard Tools are quickly interchangeable for simple and complex jobs—in large or small lots—thus minimizing your tooling costs.

PRODUCTION

on No. 3 turret lathes at CAMCO, INC.

CAMCO MACHINES A WIDE VARIETY OF PARTS LIKE THESE IN 6 TO 100 PIECE LOTS

CAMCO, INC., Houston, Texas, depends on Warner & Swaseys for small lot production of parts for their gas lift valves—equipment which lifts petroleum from oil wells whose natural forces are exhausted.

Two of these nine Warner & Swaseys are standard tooled No. 3 turret lathes which machine a wide variety of simple to complex parts from stainless steel and monel metal, in lots averaging 50 pieces. Tolerances as low as .002 are held on most jobs.

One of the No. 3's is also equipped with a full length lead screw and selective gear box to machine numerous small lot threading jobs. The threads are chased with the lead screw and an automatic knock-off attachment. Specification of the threads: standard vee or round form, special diameter, standard pitches, Class 3.

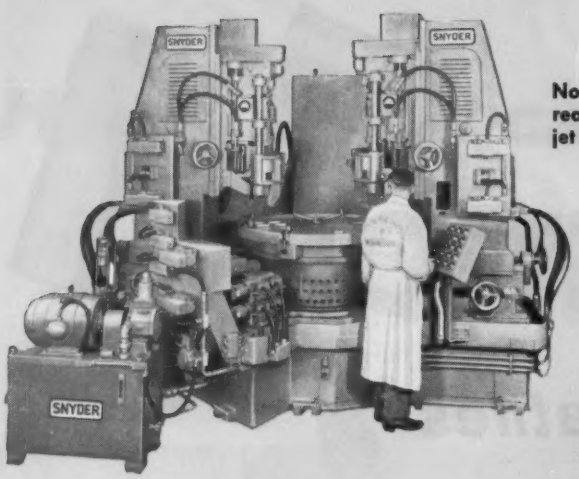
Since the day the first No. 3 machine was installed in 1954, working two 9-hour shifts per day, not one hour has been lost because of downtime for repairs! Similar performance has been achieved by their other Warner & Swaseys—No. 4 and No. 5 turret lathes, 2-A and 4-A heavy duty turret lathes, and two 5-spindle automatics.

This story again illustrates a point recognized in our customers' plants throughout the world—for dependable day-after-day production of small lots, you can't beat the versatility and accuracy of standard tooled Warner & Swasey Machine Tools!

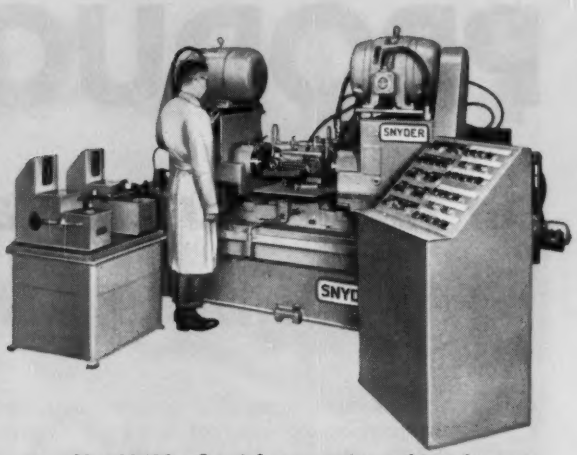
WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

For more information fill in page number on Inquiry Card, on page 229

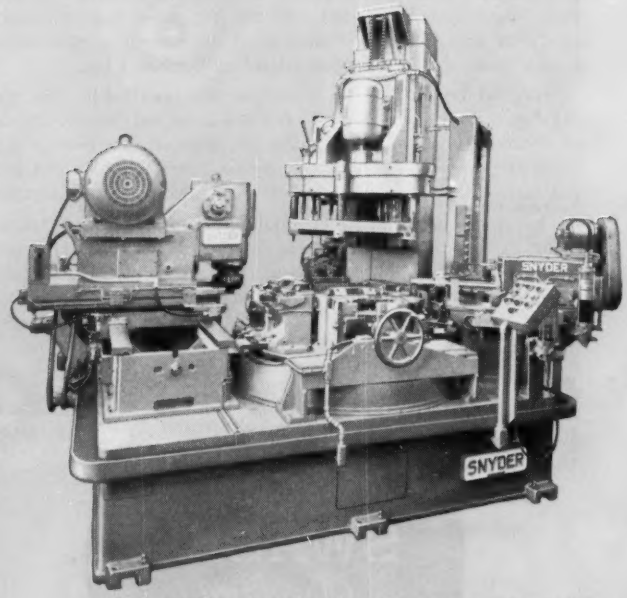


No. 70165—Special index machine to drill and ream holes in rims of outer shroud spacers for jet engines. Production 2 parts per hour.

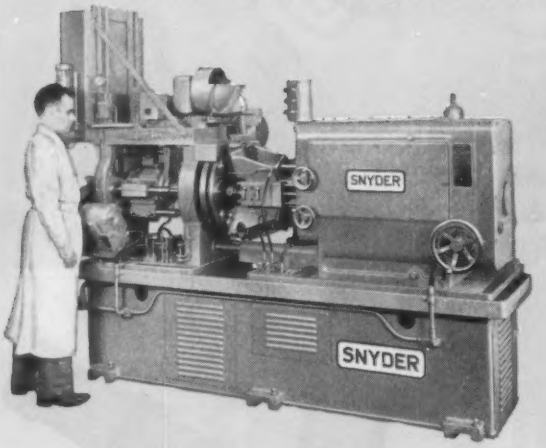


No. 65412—Special automatic machine, for weighing and precision balancing a variety of heavy-duty and diesel engine connecting rods from 7⅜" to 12" center distance. Weighs rods and automatically balance mills to plus or minus 2 grams.

No. 207390—Special, double-end precision boring machine for finish boring, counterboring and chamfering counter shaft, intermediate and shifter shaft holes on power take-off cases. Production 82 pieces per hour at 80% efficiency.



No. 73902—Special 4-station automatic index machine for milling joint face, drilling and reaming vertical and horizontal holes in exhaust manifolds. Production 80 pieces per hour at 80% efficiency.



No. 68526—Special double end trunnion machine, fully automatic, for machining special aircraft rivets. Machine is automatically loaded and unloaded. Production rate varies with size of rivet.

SNYDER VERSATILITY

in engineering and building metal-cutting machines includes not only the great Snyder line transfer machines with automation, but also many smaller and diversified machines in which the standards of performance and economy are no less exacting. A few representative examples are shown.

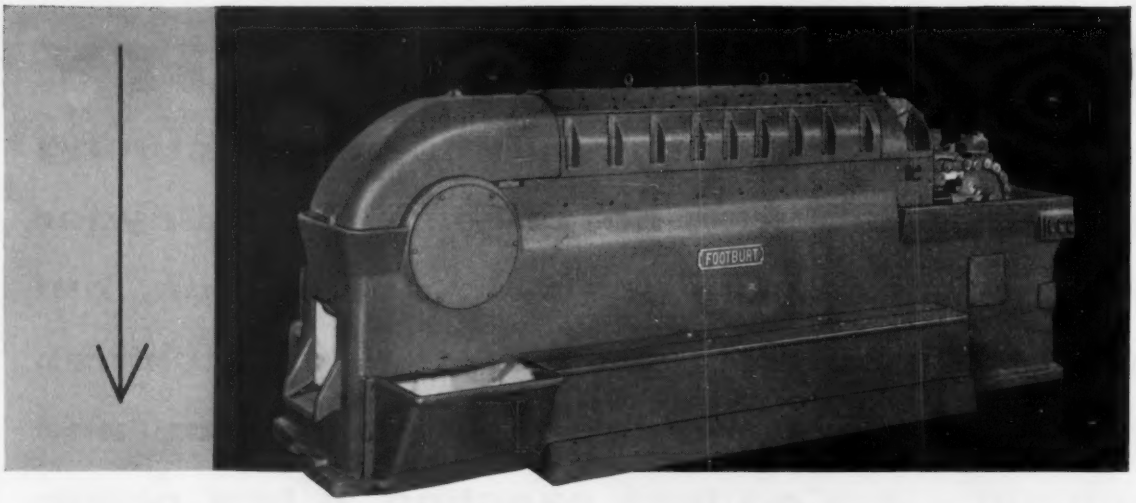
SNYDER

TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

31 Years of Special Machine Tools with Automation

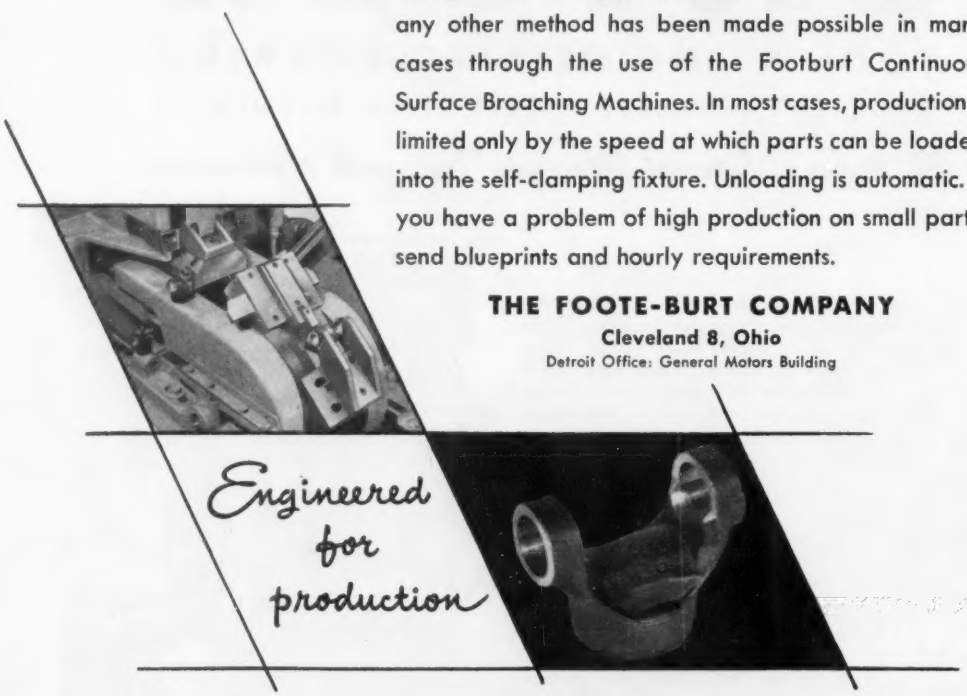
No. 72976½—Special 8-station, center column machine for processing steering gear housing. Mills pads and cover faces; spotfaces cover faces; drills, countersinks and taps mounting holes and cover holes; rough counterbores and drills shaft holes; mills two Welch plug bosses; mills sector shaft stops. Production 260 pieces per hour at 80% efficiency.



To cut machining costs, machine faster with continuous broaching

■ Higher machining production than ever achieved by any other method has been made possible in many cases through the use of the Footburt Continuous Surface Broaching Machines. In most cases, production is limited only by the speed at which parts can be loaded into the self-clamping fixture. Unloading is automatic. If you have a problem of high production on small parts, send blueprints and hourly requirements.

THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building

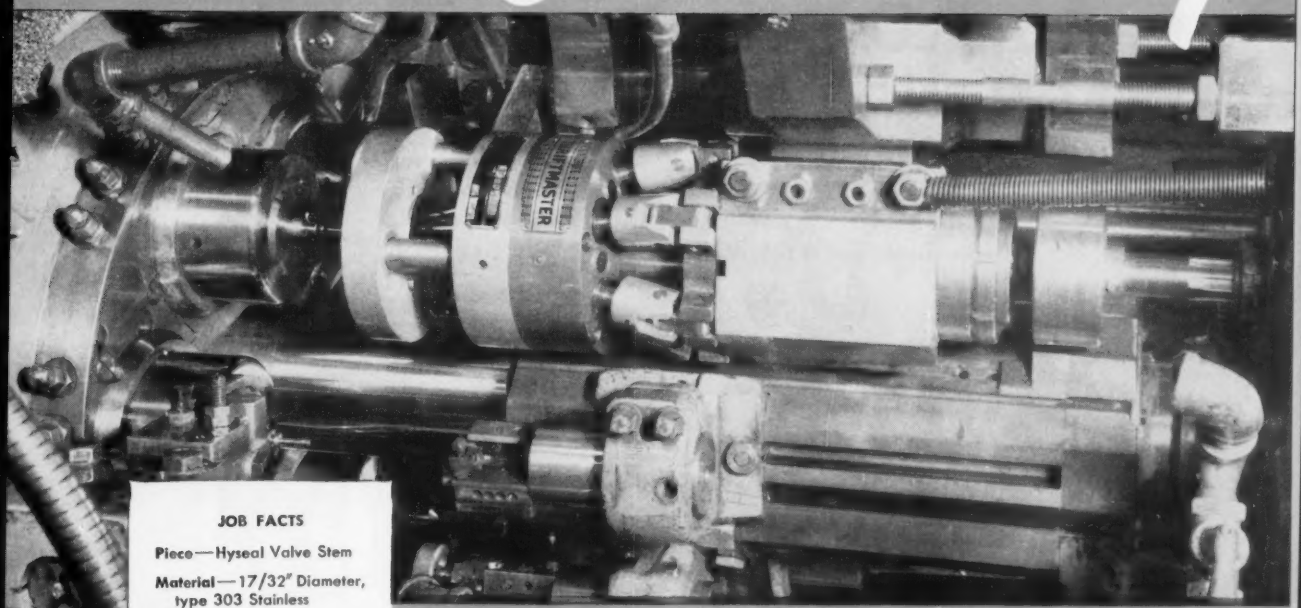


FOOTBURT

PIONEERS IN SURFACE BROACHING

For more information fill in page number on Inquiry Card, on page 229

with Acme-Gridley



JOB FACTS

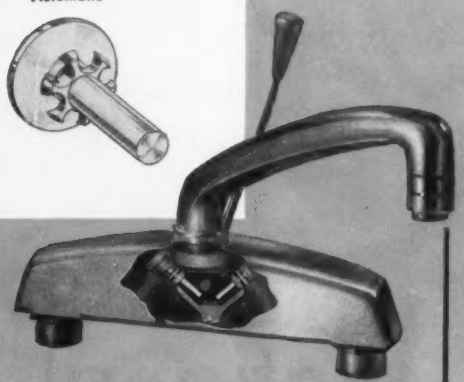
Piece—Hyseal Valve Stem

Material—17/32" Diameter, type 303 Stainless

Operations—10, including multiple end milling of six half-holes at a 15° angle

Machine Time—12 seconds

Machine—1-1/4" RA-6 Acme-Gridley Bar Automatic



Schaible Single-Lever Kitchen Mixing Faucet lets you select both the temperature and amount of water you need with one simple motion—the boon to modern living.

you get CLOSER TOLERANCES with more operations in a single setup

Following exhaustive study of other methods, the Schaible Company found that the only method of producing this valve stem to their rigid specifications at a reasonable cost was on a six-spindle Acme-Gridley bar automatic. Ten operations (including multiple end milling of six half-holes on a 15° angle) were performed in a single setup in 12 seconds machine time. Specifications required a 20 microinch finish to avoid wear on nonferrous components and working to limits of .002" t. i. r. between seating surface and end of valve stem.

BULLETIN TP-44 *shows tooling setups on 44 different bar jobs. Write today for your free copy and learn how both greater accuracy and reduced costs can be yours on an Acme-Gridley.*

National Acme

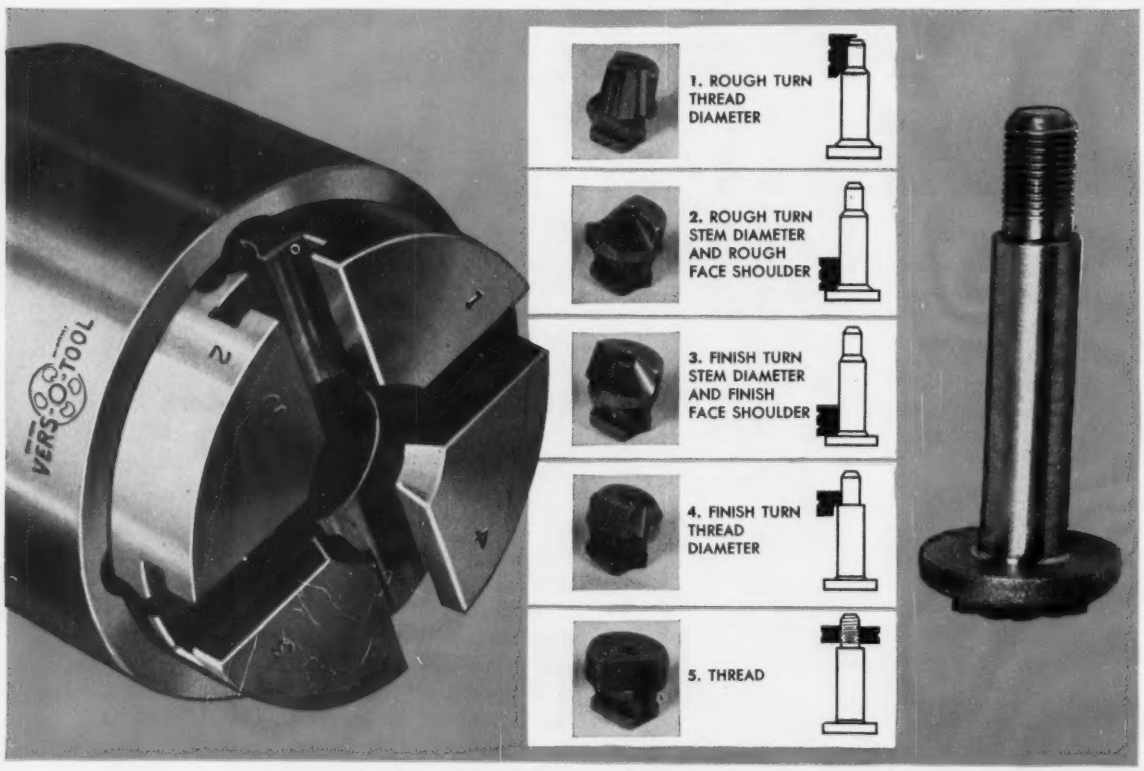
THE NATIONAL ACME COMPANY • 179 EAST 131ST STREET • CLEVELAND 8, OHIO

The Namco VERS-O-TOOL is the world's most versatile threading and hollow milling head . . . read about it on the next page →→→

HERE'S HOW NAMCO VERS-O-TOOL

CUTS COSTS... SPEEDS PRODUCTION ON END TURNING AND FORMING

In this application 300 lever supports an hour are turned out on a vertical six-spindle automatic. Vers-O-Tool machines these steel forgings three times faster than single point tools, opens at the end of the cut, leaves no spiral marks on the work.


VERS-O-TOOL
1
2
1. ROUGH TURN THREAD DIAMETER
2. ROUGH TURN STEM DIAMETER AND ROUGH FACE SHOULDER
3. FINISH TURN STEM DIAMETER AND FINISH FACE SHOULDER
4. FINISH TURN THREAD DIAMETER
5. THREAD

Vers-O-Tool licks tough production problems because:

1 Basic Vers-O-Tool design permits cutters or ground thread chasers to be changed quickly without adjustment in the head.

2 All settings in the blocks are made in the tool-room with a micrometer gauge—no need for trial and error run after changing or grinding.

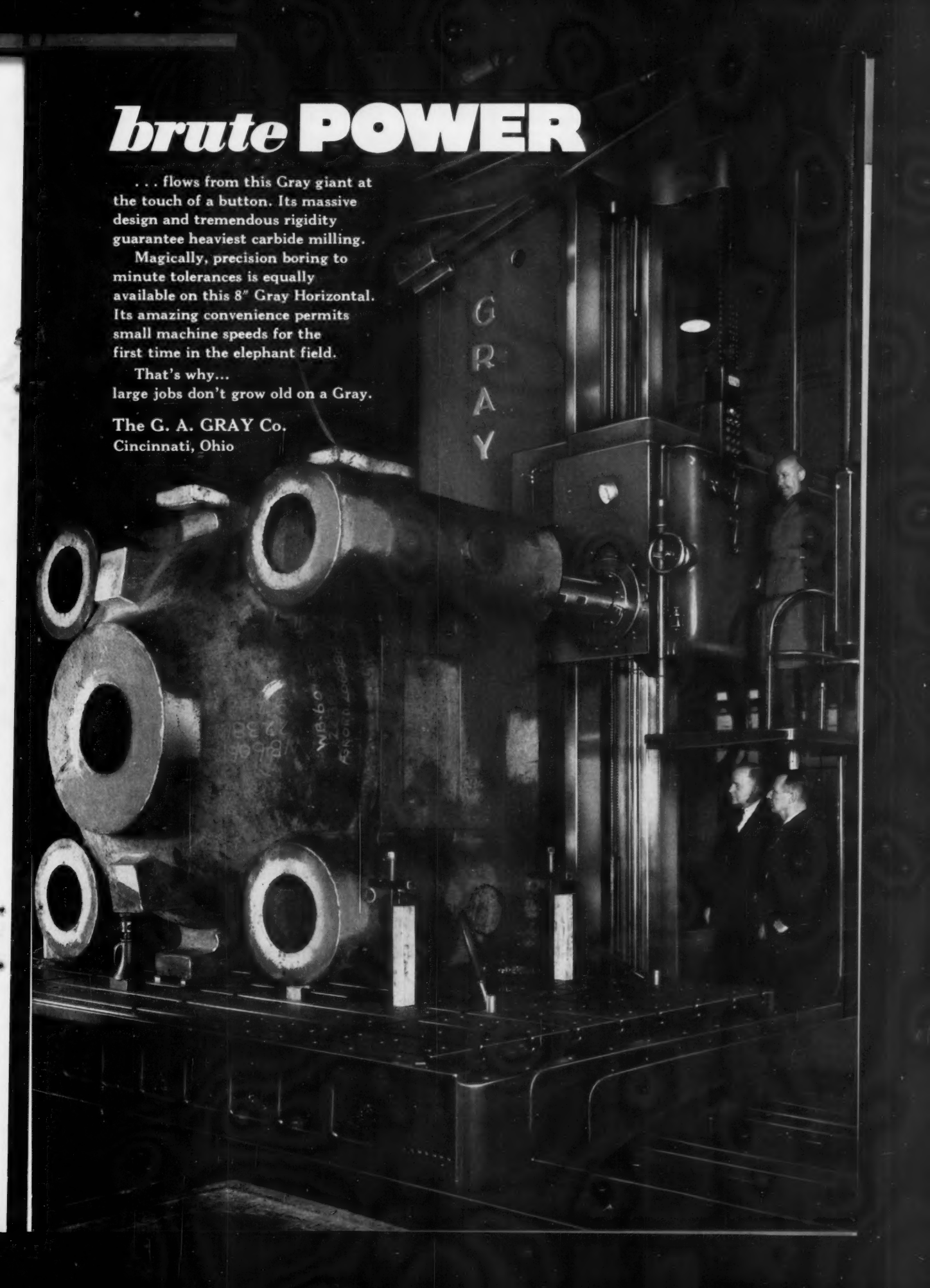
SEND FOR THIS CATALOG DT-52

the National Acme company

179 EAST 131ST STREET • CLEVELAND 8, OHIO

←←← WANT CLOSER TOLERANCES?... See (on preceding page) how ACME-GRIDLEY Tooling Experience solved critical tolerance problem

For more information fill in page number on Inquiry Card, on page 229

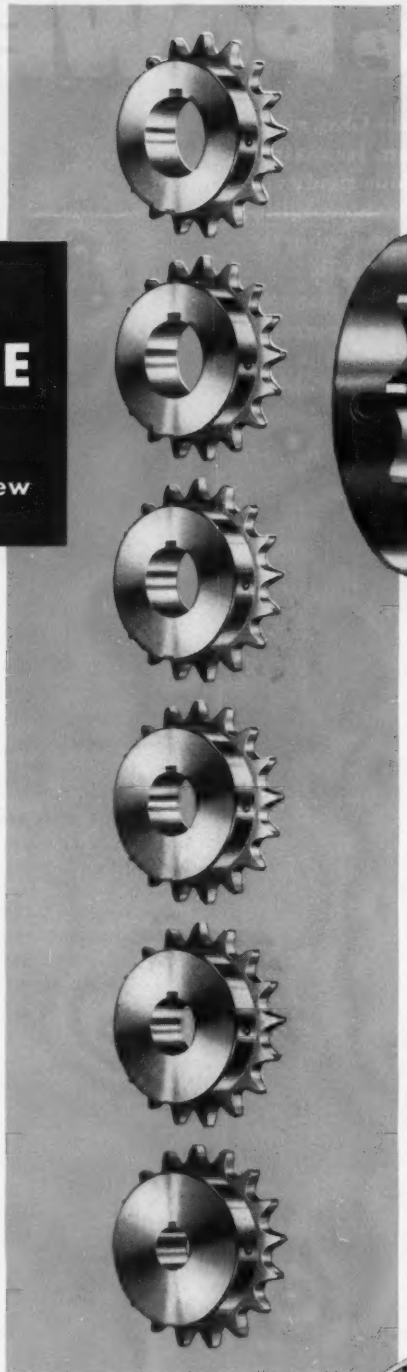

brute POWER
. . . flows from this Gray giant at the touch of a button. Its massive design and tremendous rigidity guarantee heaviest carbide milling.
Magically, precision boring to minute tolerances is equally available on this 8" Gray Horizontal. Its amazing convenience permits small machine speeds for the first time in the elephant field.
That's why...
large jobs don't grow old on a Gray.
The G. A. GRAY Co.
Cincinnati, Ohio
GRAY

NOW! — another cost-saving service from your nearby **BOSTON Gear** DISTRIBUTOR

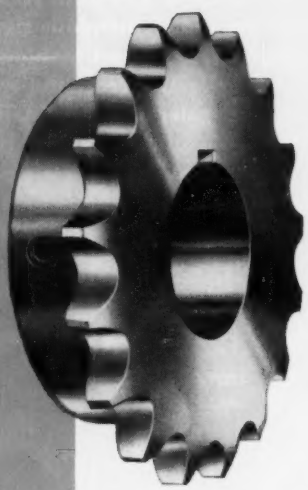
STANDARD STOCK

BORED-TO-SIZE SPROCKETS

complete with Keyway and Setscrew



76 TOOTH SIZES
321 STOCK BORES



"OFF-THE-SHELF" — AT FACTORY PRICES

FINISH BORED — READY TO INSTALL Single width steel sprockets 3/8" Pitch through 1" Pitch—in 76 commonly used Tooth Sizes —with a full selection of finished bore diameters for each sprocket—complete with keyway and setscrew.

ELIMINATE BORING EXPENSE You save expense of reboring, keyway cutting, drilling and tapping for setscrew—and avoid downtime in emergency replacements.

BOSTON GEAR QUALITY Sets the standard for precision and performance—assures longer service life for both sprockets and chain.

OFF-THE-SHELF DELIVERY More than 100 BOSTON Gear Distributors can supply BORED-TO-SIZE Sprockets from stock. Get complete information, on any question of sprocket selection or application, from factory-trained specialists . . . at the Distributor near you. Boston Gear Works, 65 Hayward St., Quincy 71, Mass.

The BOSTON Gear complete line provides any Sprockets you need including SHOLD-A-GRIP interchangeable tapered Sprockets and Bushings. For complete listings, see BOSTON Gear Catalog No. 56.

CALL YOUR **BOSTON® Gear** DISTRIBUTOR

For nearest Distributor, look under "GEARS" in the Yellow Pages of your Telephone Book.

56BG-S-23

For more information fill in page number on Inquiry Card, on page 229

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

HOW THIS RAM TYPE TURRET LATHE WENT AUTOMATIC

Hydraulic Drive Gives Maximum Production with Minimum Operator Attention

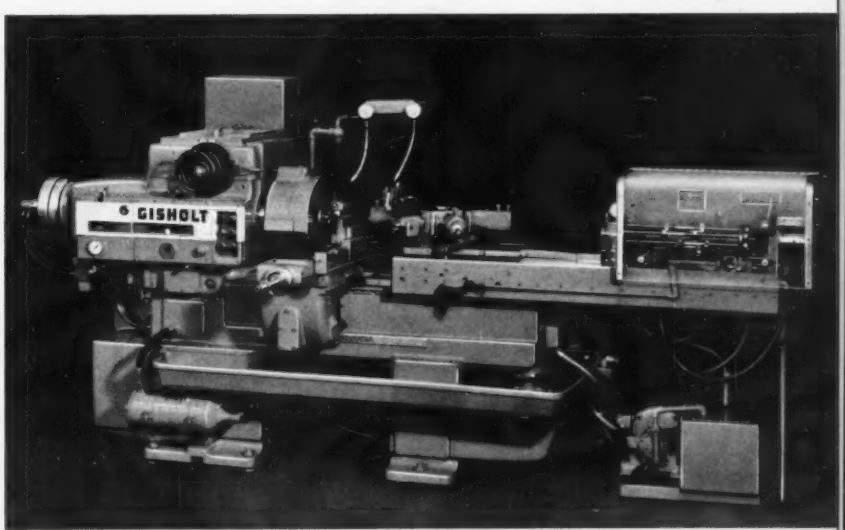
This appliance manufacturer was quick to take advantage of the possibilities of the new Gisholt MASTERLINE Ram Type Turret Lathe. By using two Gisholt No. 4 machines with automatic hydraulic drive, he put production of kitchen disposal unit parts on an automatic basis.

Here's how one of the parts—a cast iron flywheel—is handled. The workpiece is held in a two-jaw air chuck, through two holes cast in the face. The work locates against the back face, with spring-loaded pins eliminating vibration. The following operations are performed automatically, including necessary spindle speed changes: hexagon turret tools turn B, face D-F, form relief E, and drill, bore and tap G. At the same time, tools on the rear of the cross slide straddle-face A-C. Floor-to-floor time: 1.75 minutes. Similar machining operations at both ends of cast iron housings are also handled on these machines.

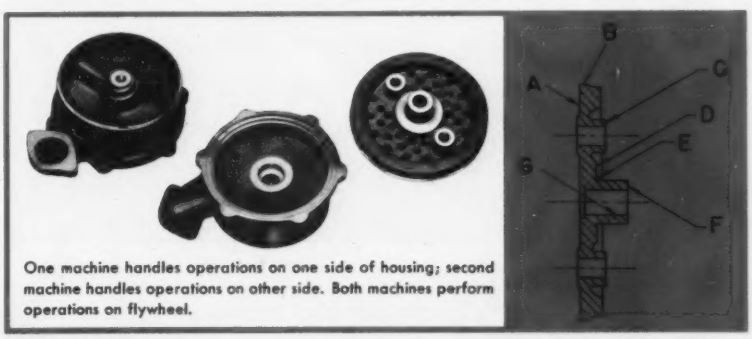
This hydraulic drive unit is equally efficient on long or short runs, with average setup time of only 1.4 hours for a fully tooled hexagon turret and two cross slide tools.

Easily adapted to any new Gisholt MASTERLINE Ram Type Turret Lathe, the hydraulic drive unit provides full automatic cycle with automatic spindle start and stop, reverse for threading... selection of any spindle speed for each station... fast approach, feed and return of turret... and infinitely variable feeds for better finish and closer tolerance work. The cross slide operates automatically in both directions.

Equipping a standard ram type turret lathe with automatic hydraulic drive boosts production and reduces need for close attention, skill and effort from operator.



General machine view showing hydraulic drive mounted on standard ram type turret lathe. Controls are simple, conveniently placed, and easily set up and adjusted. *For complete information on hydraulic drive, ask for Form 1182. Bulletin 1174-B describes MASTERLINE Ram Type Turret Lathes.*



One machine handles operations on one side of housing; second machine handles operations on other side. Both machines perform operations on flywheel.

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

POWER, SPEED, VERSATILITY LICKED THIS JOB

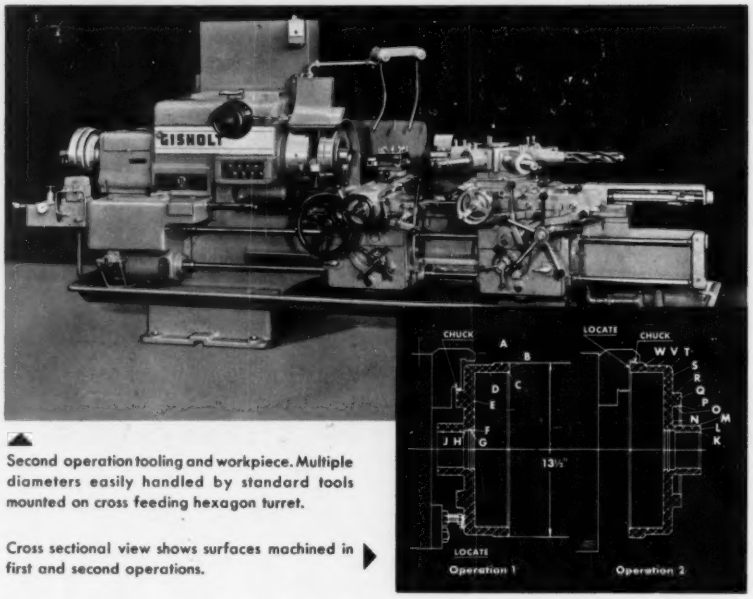
How Smart Tooling Combined with Cross Feeding Hexagon Turret Shorten Change-Over Time

This job would be difficult with a machine less capable than the 1L Saddle Type Turret Lathe. Instead, the workpieces—aluminum air cylinder bodies—are machined in two fast operations. Heavy cuts are handled easily by the husky 30 h.p. motor, and spindle speeds up to 1850 r.p.m. help assure a fine finish on all surfaces machined.

Special two-step chuck jaws are used. Serrated steps grip at R for the first operation and plain steps chuck on A for the second operation. Tooling for both operations is mounted on the cross feeding hexagon turret. For change-over, one tool is removed and two new tools are added on the square turret.

During the first operation, A-B-C are handled from the square turret with D-E-F-G-H-J machined from the hexagon turret. Floor-to-floor time: 7.8 minutes.

For the second operation, square turret tools machine K-L-P-Q-S-T-V-W. A single tool on the cross feeding hexagon turret is used to turn M, plunge N-O and turn R, completing the part. Floor-to-floor time on this job: 5.5 minutes.



Second operation tooling and workpiece. Multiple diameters easily handled by standard tools mounted on cross feeding hexagon turret.

Cross sectional view shows surfaces machined in first and second operations.

Special chuck jaws and carefully planned tooling on the hexagon and square turret simplify change-over.

HOW BRITISH AUTO BUILDER SUPERFINISHES CRANKSHAFTS

Modern Process Replaces Former Grinding Operation

Owners of Morris autos are getting smoother, lower-cost engine operation these days—because of a Gisholt Model 56 Single Spindle Crankshaft Superfinisher. It is interesting to note how Morris Motors, Ltd., of Coventry, England, is handling the job.

Gisholt Model 56 Crankshaft Superfinisher in operation at Morris Motors, Ltd.

The crankshafts are centralized on the flange O.D. and supported with a center at the pulley end. Longitudinal location is against the face of the flange, and drive is taken from a hole in the flange.

Both the main and pin bearings are Superfinished simultaneously. Stone pressure is adjustable for each main or pin bearing. During the automatic cycle, the workpiece rotates and reciprocates as the stones engage the work. Crankshafts come to the Superfinisher with bearing surfaces of 30 to 40 micro inches. These are Superfinished down to 10 micro inches or less, with 35 parts an hour handled at 80% efficiency.

By Superfinishing, this auto builder cuts grinding costs on crankshafts—and gets smoother surface and improved geometry for finer performance and longer wear.

GISHOLT

TIME-SAVING IDEAS

MODERN BALANCING MADE FASTER, EASIER

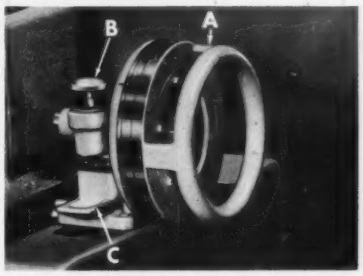
Amount Meter Reads in Terms of Correction Method Employed for the job

It's a proven fact: for maximum efficiency in handling small electric motor armatures or similar parts, a balancing machine must indicate directly the amount of alteration or correction required—and the exact angular location of unbalance—in each of two correction planes.

By using a direct reading amount meter, Gisholt Balancing Machines are providing these indications more quickly and in terms easily understood by any operator. Because Gisholt uses electrical means to locate and measure unbalance effects, it is a simple matter to adjust the amount meter to read in correction units most practical for the work.

On this job, the correction unit is a length of solder. The Gisholt 1S is equipped with a metering device with which the length of solder is quickly measured and cut off. Handwheel A is turned to a number corresponding with the observed meter reading. As plunger B is depressed, the amount of solder required for correction is cut off and deposited in tray C. The operator is shown applying the metered length of solder to make the balancing correction. Workpieces like this are balanced and corrected in less than one minute floor-to-floor time.

Production balancing time is sharply reduced by Gisholt Balancers' ability to indicate unbalance in terms of practical correction units. Direct reading—plus metering device—eliminates need for charts, graphs and translating data.



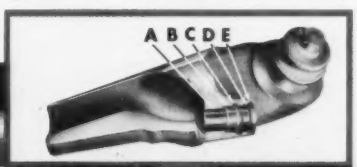
Operator uses soldering iron to apply metered length of solder at the angle indicated in each correction plane. Close-up shows metering device which provides measured length of solder.

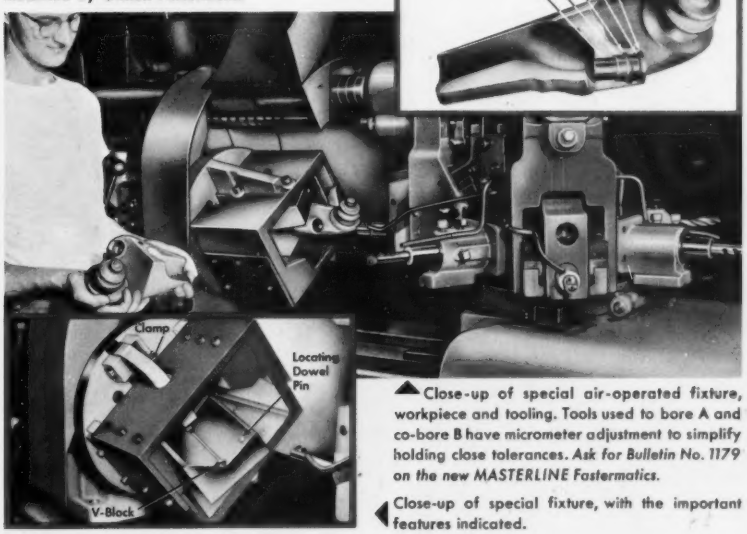
SPECIAL FIXTURE SIMPLIFIES MACHINING OF ODD-SHAPED PARTS

Automatic Machine Cycle Improves Accuracy, Reduces Operator Effort

Three forged steel jet arms, welded together, form the familiar oil well rock bit body. Each jet arm has a cutter mounting spindle and a high-pressure jet nozzle to flush material during drilling. Machining of this jet nozzle bore is complicated because its center line is different from the center lines of both the cutter mounting spindle and the welded rock bit body.

Workpiece with section removed to show surfaces machined by Gisholt Fastermatic.





▲ Close-up of special air-operated fixture, workpiece and tooling. Tools used to bore A and co-bore B have micrometer adjustment to simplify holding close tolerances. *Ask for Bulletin No. 1179 on the new MASTERLINE Fastermatics.*

◀ Close-up of special fixture, with the important features indicated.

In addition, the surface finish and bore tolerances are critical and must be closely held. Here is how this Gisholt 2F Fastermatic Automatic Turret Lathe was tooled to overcome these problems.

The workpieces arrive with two adjacent faces machined to form an angle of 120 degrees and with a hole drilled in one face for locating purposes. They are placed in a special air-operated fixture on a V-block insert, mating with the machined surfaces, locating the work on center. A dowel pin provides accurate longitudinal location. A pivot-type clamp holds the work on the shank O.D.

Machining is simple. Front and rear cross slides are eliminated to permit swinging the fixture. Hexagon turret tools bore A and co-bore B. Overhead stop actuated internal facing tools form C-D and E is chamfered to finish the job.

Floor-to-floor time on this 8¾" size jet arm is 4.2 minutes. Because several part sizes are handled, the V-block insert is replaceable, keeping change-over time at a minimum on this job.

GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

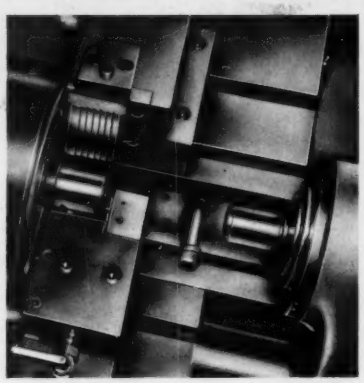
SMART SETUP PERFORMS TWO-SEQUENCE JOB IN ONE CHUCKING

Two-Speed Motor Provides Correct Spindle Speed for Each Operation

Here is a dramatic example of what you can do with the Gisholt No. 12 Automatic Production Lathe. You may get some ideas from the interesting tooling setup shown here in the photos.

Workpieces are 2″ welded pipe stems made from steel tubing. Parts arrive cut to rough length and threaded at one end. They are placed in an air-operated collet chuck, located against the threaded end and chucked on the unmachined O.D.

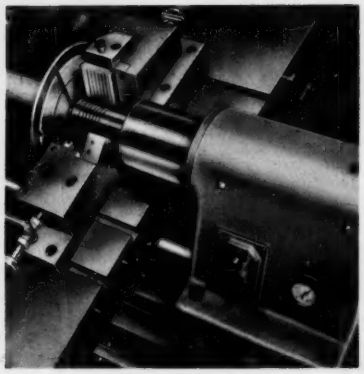
For the first part of the job, spindle speed is 330 r.p.m. and the feed is .022″. Tools on the carriage are fed longitudinally, turning the O.D., shave-facing to length and chamfering the interior of the bore. The carriage then reverse feeds to clear the chamfer tool, and moves transversely out of the way.



Turning, facing and chamfering are completed from front carriage. Note tailstock is retracted.

The air-operated tailstock advances automatically to support the part in the chamfered bore. Spindle speed drops to 82 r.p.m. and the feed to .005″. O.D. radius and seven serrations on the tube are machined in a heavy forming cut from the rear independent slide. Floor-to-floor time for the complete job is only .6 minute.

Complex feeding motions of the front carriage are easily obtained and extra handling is eliminated, with all operations performed in a single chucking.

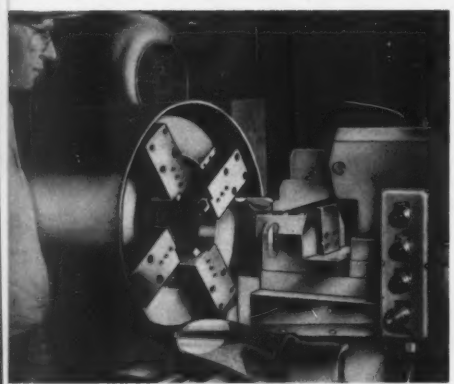


Tailstock supports during heavy forming cut made from rear independent slide.

Left to right—rough workpiece; after turning, facing and chamfering; completed part.

CURVED SURFACE GENERATED BY SPINDLE-MOUNTED TOOLS

Fixture Mounted on Platen Table Feeds Work into Tools



Close-up of work and tooling. Smallest workpiece handled is shown in fixture. Largest is on platen table in foreground.

This unusual arrangement permits machining curved surfaces on the ends of forged steel bit head sections at high production rates.

The machine is a Gisholt Simplimatic Automatic Lathe. Work is held in a V-block fixture mounted on the platen table, with the shank end locating against a dead stop. An air-operated clamp holds the part securely in place. The platen table traverses the work to the tools and changes to feed. The severe interrupted cut is divided between four tools mounted on a special face plate fixture. At the end of the cut, the base supporting the fixture is shifted, relieving the workpiece instead of the tools.

Several different sizes are handled. Diameters range from approximately 5¾″ to 12″. The smallest part requires .6 minute, and the largest 1.10 minutes floor-to-floor time. For fast change-over from one size to another, tool blocks are changed, V-block is replaced in fixture, inserts are changed in clamping jaw, and locating stop is adjusted.

Flexibility offered by platen table permits "reverse" tooling setup, allowing work to be fed into tools on the spindle. Tools are pre-set to further simplify this setup.

No. 5-656
655

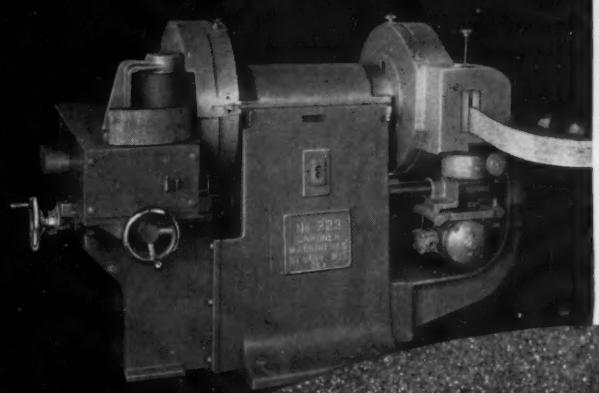
GISHOLT

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Change in Grain Size and Structure Cuts Abrasive Costs 80%

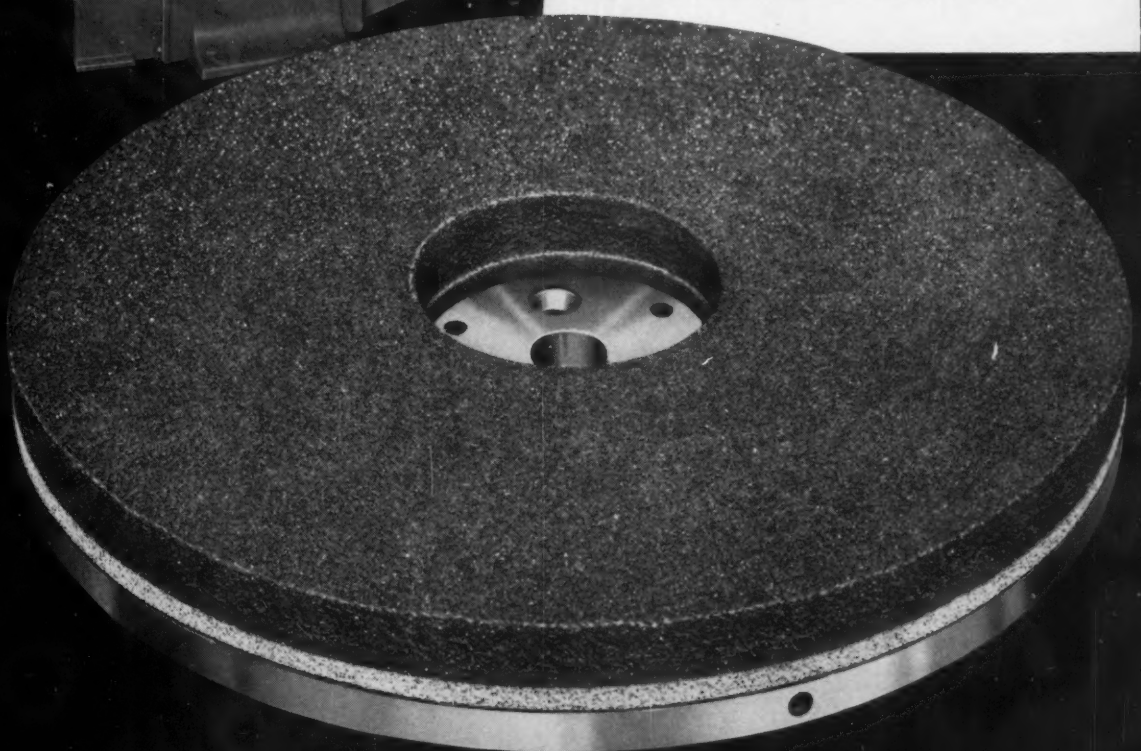


Grizzly Manufacturing Division grinds 5½ times more brake lining per disc

An 80% cut in abrasive disc costs in grinding brake lining is reported from Grizzly Manufacturing Division of Paulding, Ohio.

Looking for ways to cut costs, their production men called in the Gardner Abrasive Specialist. Could Gardner make discs that wouldn't wear out so quickly?

The new Gardner disc stepped up production from 454,790 to 2,512,200 feet of lining per disc. That's 5½ times more production for each disc! Downtime for disc replacement has been turned into productive time.



GARDNER

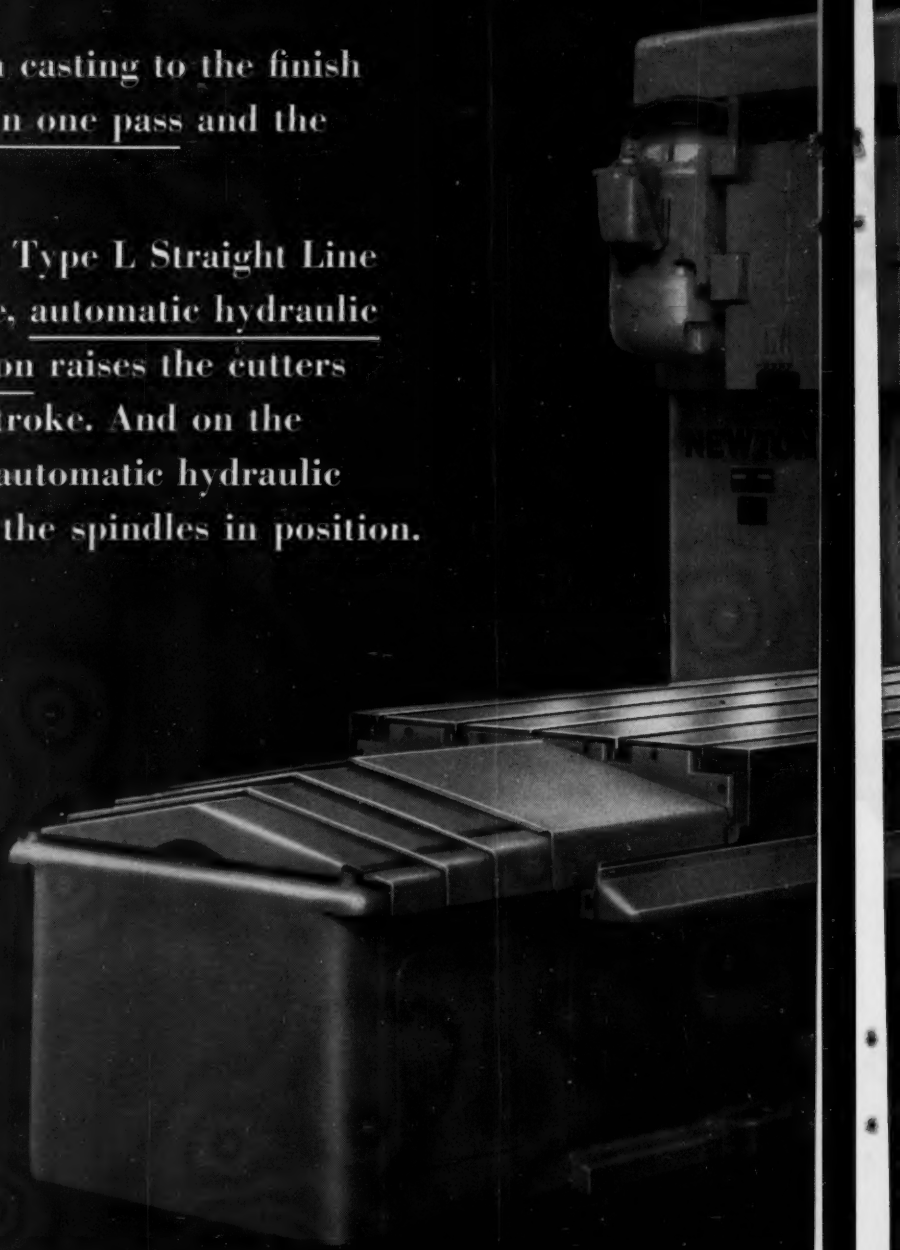
abrasive discs

BELOIT, WISCONSIN, U.S.A.

One Pass . . . and

From the rough casting to the finish milled surface in one pass and the job is done!

On this Newton Type L Straight Line Milling Machine, automatic hydraulic spindle retraction raises the cutters on the return stroke. And on the milling stroke, automatic hydraulic clamping locks the spindles in position.

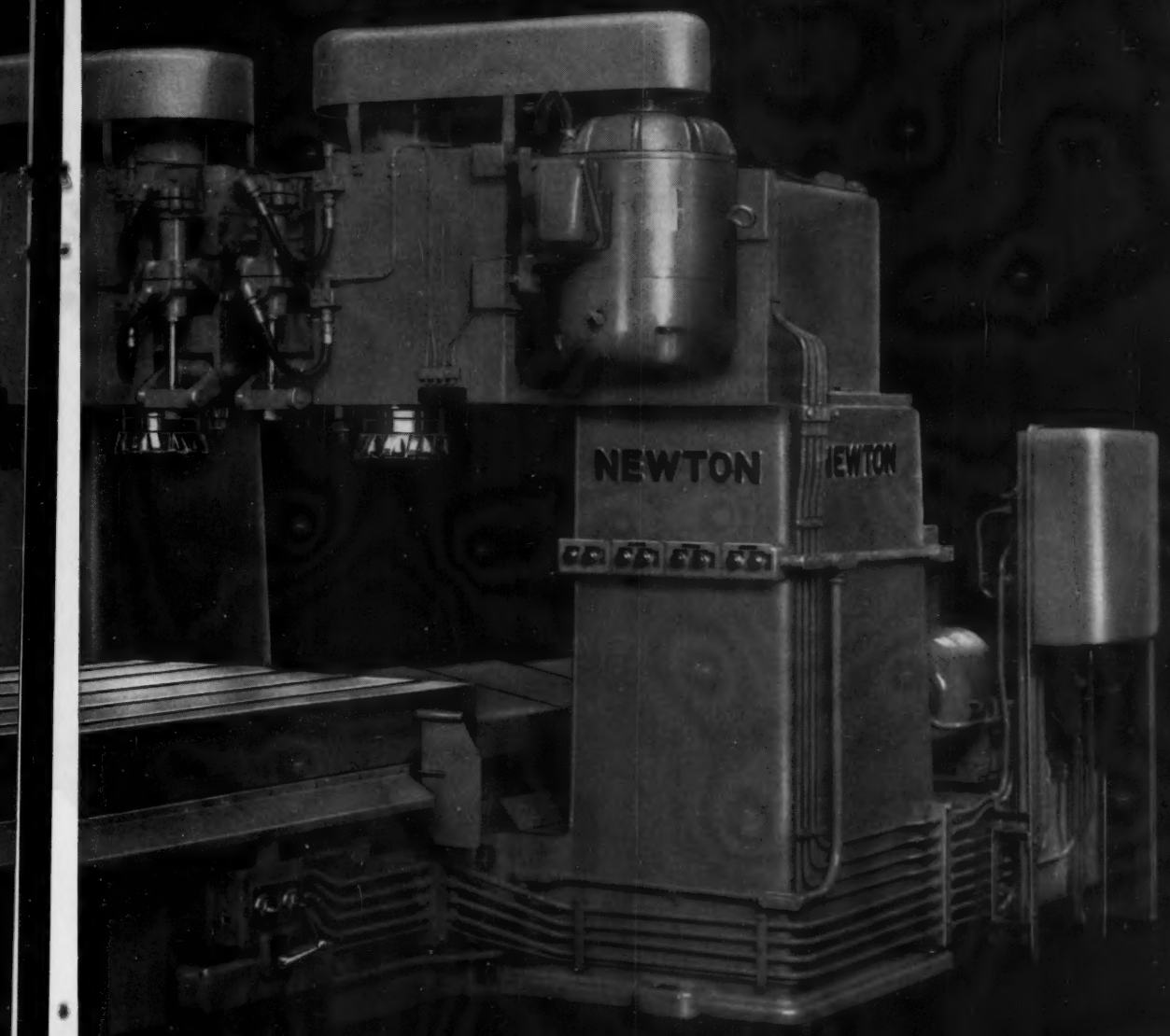


Newton Type L Straight Line Milling Machine with 20 H.P. heads for one-pass milling of aluminum crank cases.

CONSOLIDATED MACHINE TOOL

A Division of Farrel-

the Job is Done!



COMPANY, ROCHESTER 10, N. Y.

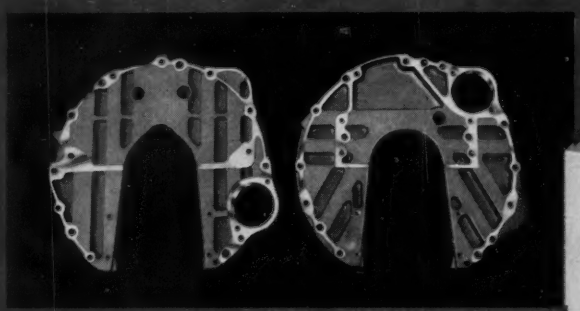
Birmingham Company, Incorporated

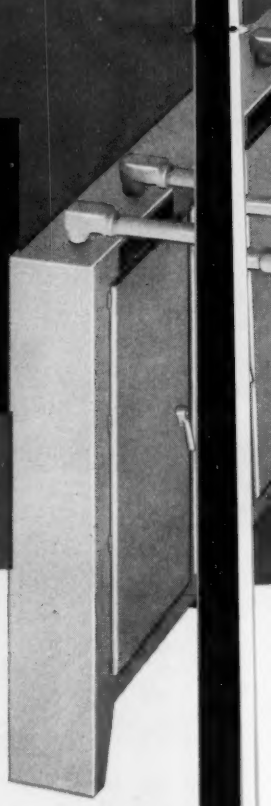
Buhr ECONOMATIC

performs 155 operations on two types of torque-converter adapter plates!

Production . . . 200 pieces per hour at 100% efficiency

Operations . . .
37 drilling, 12 reaming,
4 boring, 37 countersinking,
36 inspection
and 29 tapping





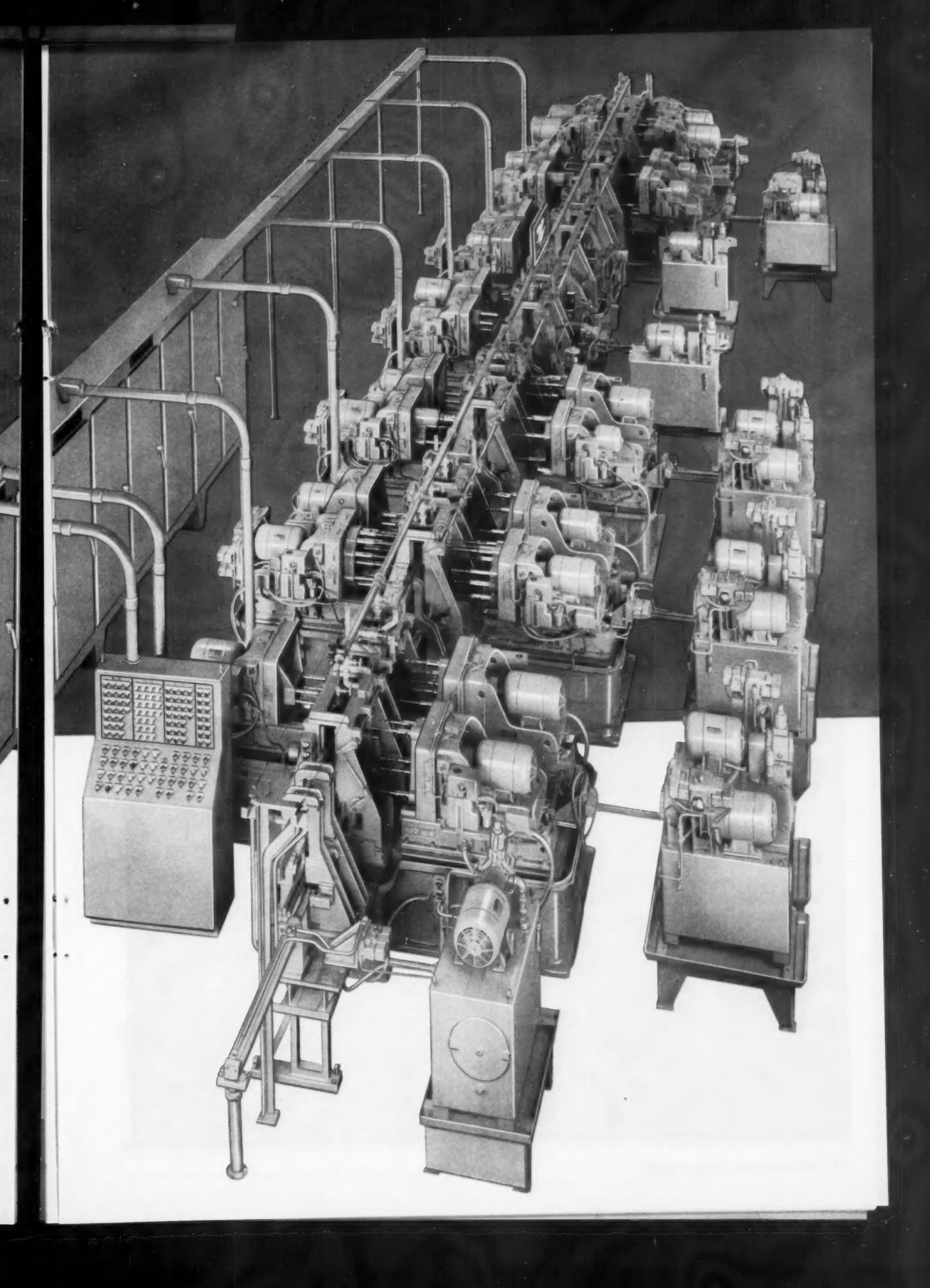
- Two types of plates may be loaded at random. Machine automatically selects and performs required operations
- Sectionalized bases to facilitate future part changes
- Automatic lubrication of all moving parts
- Mist-lubrication to all spindles to maintain uniform temperature in heads
- All spindles arranged for pre-setting of cutting tools to minimize downtime for tool changes
- Hardened-and-ground steel ways
- All standard and special parts interchangeable for ease of maintenance
- Machine conforms to J.I.C. Standards

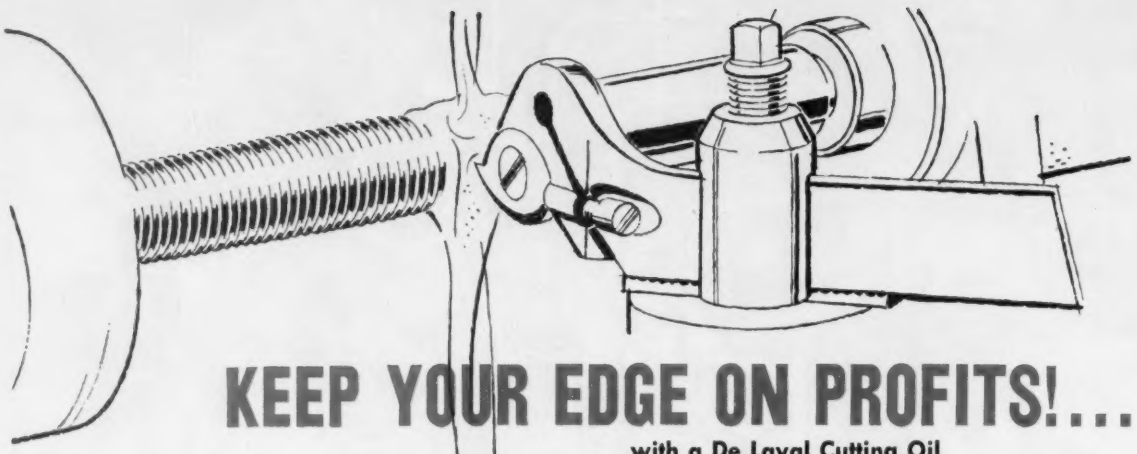
Buhr
MULTIPLE-SPINDLE
HIGH PRODUCTION MACHINERY

BUHR MACHINE TOOL CO.©

ANN ARBOR, MICHIGAN

Solidly Engineered · Precision Built · for World's Leading Manufacturers





KEEP YOUR EDGE ON PROFITS!...

with a De Laval Cutting Oil Extraction and Purification System

With a De Laval System you get...

Markedly reduced tool wear... less tool dressing... less down-time for tool replacement...

More consistent machining to close tolerances...

Longer cutting oil life...

More efficient reclamation of oil. (From this saving alone some De Laval installations have returned their *entire* cost in a *single* year.)

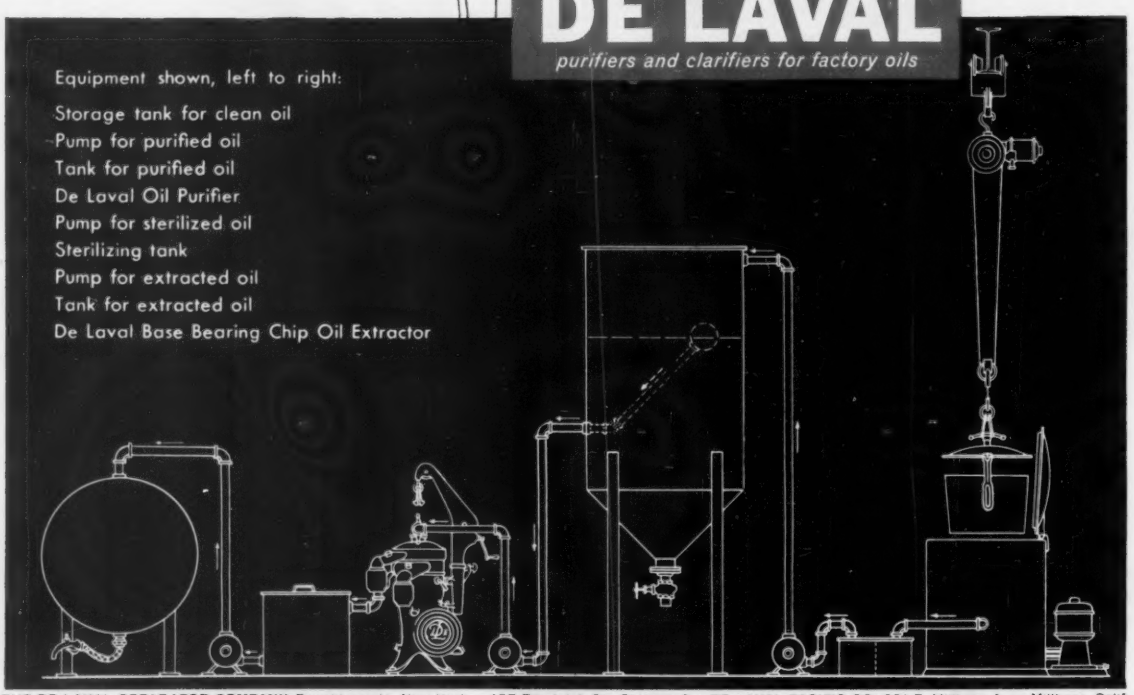
Get all the money-making facts... write *now*.

DE LAVAL

purifiers and clarifiers for factory oils

Equipment shown, left to right:

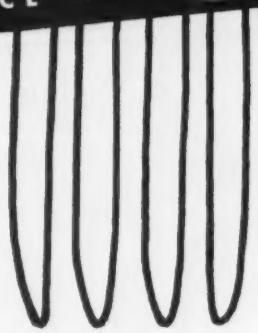
Storage tank for clean oil
Pump for purified oil
Tank for purified oil
De Laval Oil Purifier
Pump for sterilized oil
Sterilizing tank
Pump for extracted oil
Tank for extracted oil
De Laval Base Bearing Chip Oil Extractor



THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

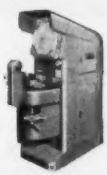
DROODLES

by ROGER PRICE



Bench Model BC-7D

Floor Model FC-30



Floor Model FC-14

"POTATO'S EYE VIEW OF A FORK"

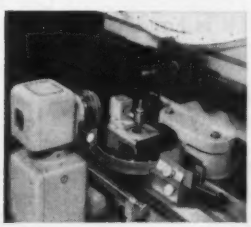
This Droodle presents several fascinating possibilities. Turned upside down, the title could be "Yeast-cake Quartet Rising to the Occasion". Best of all, though, I'd like to add little squiggly lines, and call it "Tines getting in Tune". But squiggle-drawing makes me nervous. Gee, I wish I were normal! But if I were, then my psychiatrist wouldn't have that shiny new Continental. Just goes to prove that every problem has a silver lining.

If *you* have a problem . . . concerning quality control inspection . . . here's *your* silver lining: the J & L Optical Comparator. It's an incredibly flexible precision inspection instrument that inspects and measures all sorts of parts and objects.

The J & L Comparator not only is a great aid in production-line inspection, it is also ideally suited to job-shop work. It's versatile, *easy* to operate, accurate to .0001", and makes speedy inspection a cinch. Eleven models available. Send coupon now for full information.

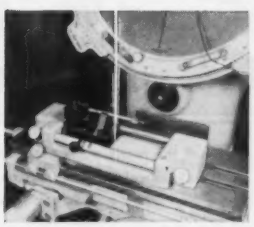
JONES & LAMSON OPTICAL COMPARATORS

Precise . . . Rapid . . . Flexible . . . Easy to operate



A J & L Comparator, with special fixture and chart, easily and perfectly measures a 3-dimensional cam. This is traditionally one of the most difficult of inspection jobs.

This inexpensive J & L Comparator is precisely measuring four small parts, of different sizes, with the same setup.



A J & L Comparator can measure shoulder lengths to closest tolerance, swiftly and accurately. The fixture shown here accommodates a wide variety of parts.

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 512 Clinton Street, Springfield, Vermont, U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete J&L line of optical comparators.

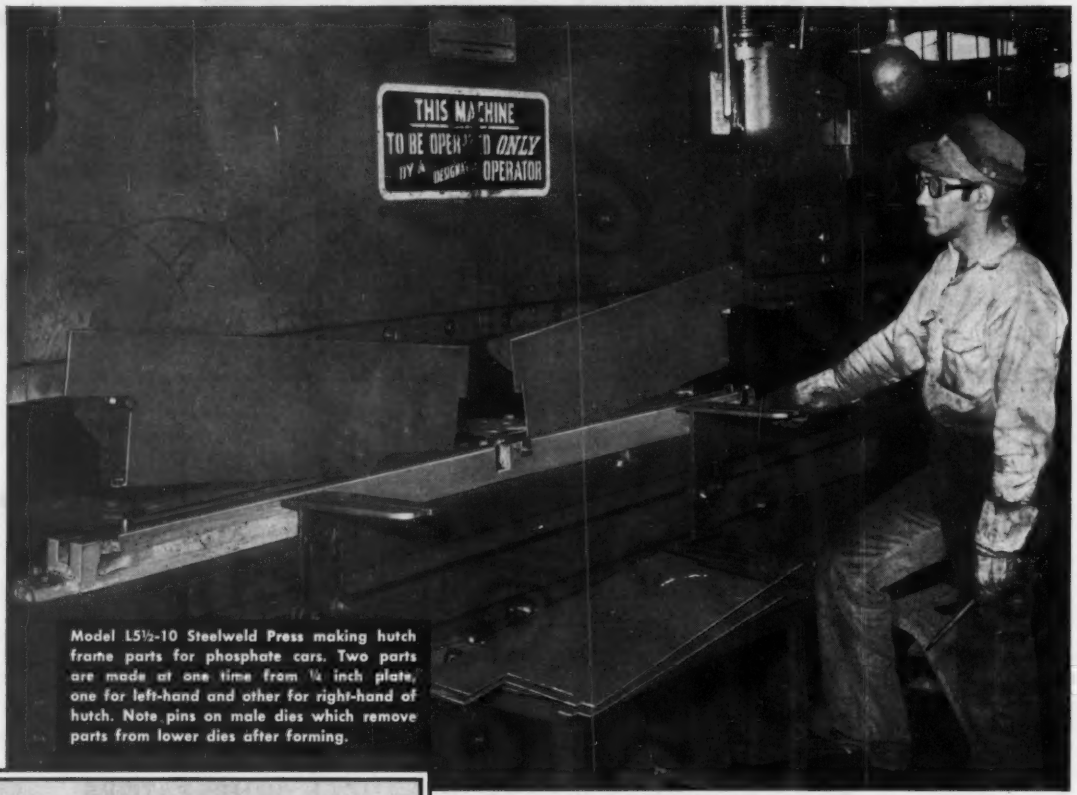
name _____ title _____

street _____

company _____

city _____ zone _____ state _____

PULLMAN-STANDARD FINDS MANY USES FOR STEELWELD PRESS



Model L5½-10 Steelweld Press making hutch frame parts for phosphate cars. Two parts are made at one time from ¼ inch plate, one for left-hand and other for right-hand of hutch. Note pins on male dies which remove parts from lower dies after forming.

A few of the many parts produced within a short period on the Steelweld Press. Curves and bends of every shape and degree are formed quickly and accurately.

"The more we use our Steelweld Bending Press, the more we learn about what it can do for us", said the Day Superintendent of Pullman-Standard Car Mfg. Co., Butler, Penna. "As a result it is handling more and more of our work. We are doing a great many forming jobs on it that did not occur to us as being possible when we first installed the machine."

An endless variety of parts are produced on this press. These are mostly of ¼ and ⅜ inch steel plate and involve curves and bends of every description for gussets, fulcrums, braces, frames, housings, etc. used in the manufacture of railroad cars.

The dies used are relatively simple and made in the company's shop. Because dies are easily changed, it usually takes about an hour to set up for a new job.

If you work with metal plate in any thickness up to one inch, for bending, forming or punching, you should get the facts on the many features of Steelweld Presses.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

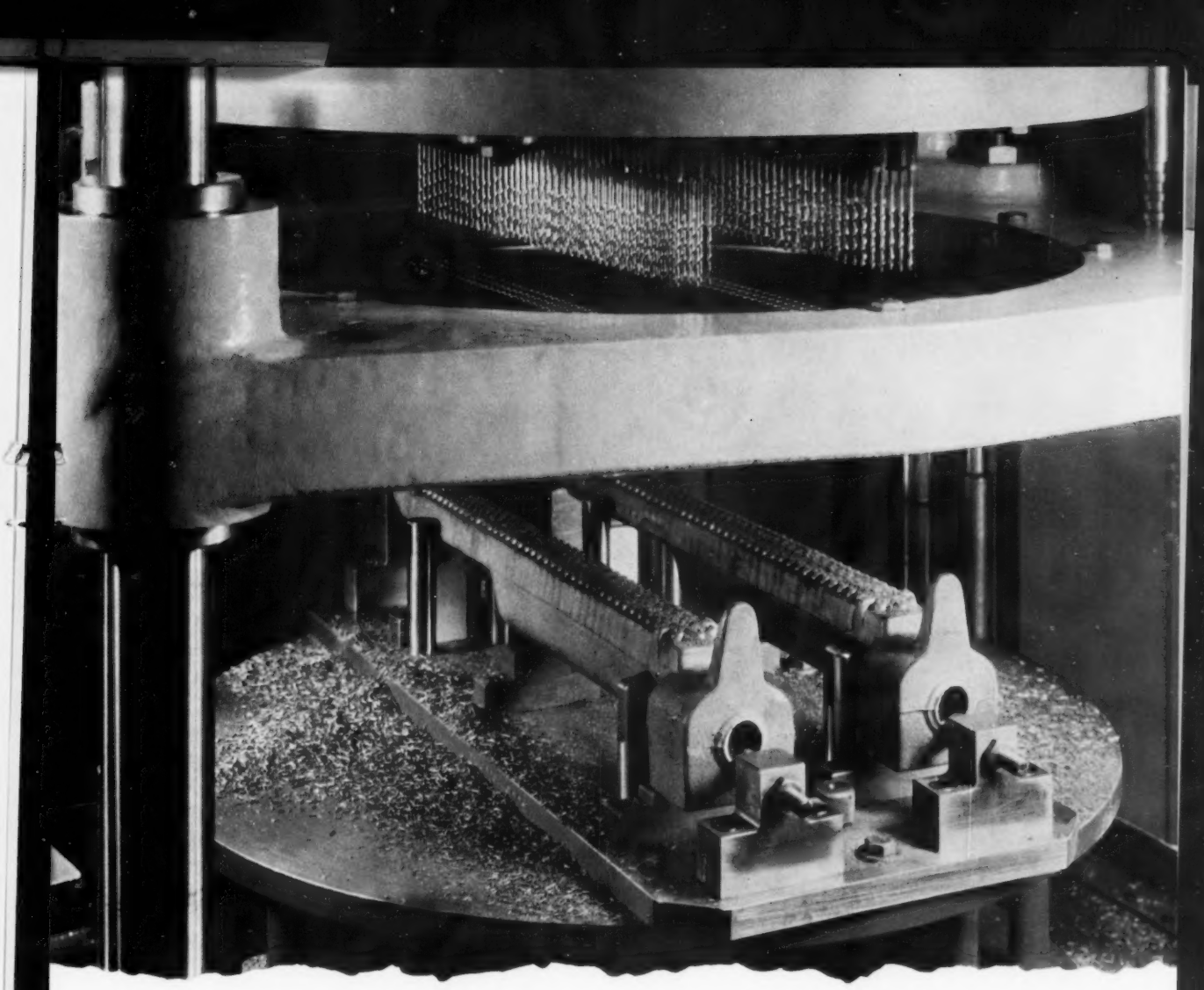
THE CLEVELAND CRANE & ENGINEERING CO.

5430 EAST 281 STREET, WICKLIFFE, OHIO

STEELWELD

BENDING PRESSES

BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING



Uniform quality and high performance of CLE-FORGE High Speed Drills can help you reach production quotas

COSTLY "DOWN TIME" REDUCED!

• You can keep your drilling operations *on schedule* with CLE-FORGE High Speed Drills. These fine quality tools give superior performance on *every set-up* . . . and you can rely on their *uniformity* day after day, month after month, year after year.

◈ Why not ask a Cleveland Service Representative for suggestions on reducing "down time" and increasing production in *your* shop? Contact our nearest stockroom, or . . .

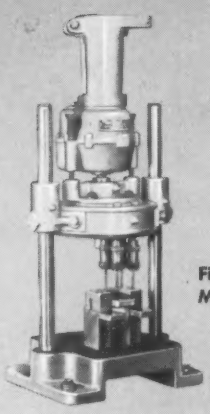
TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

THE CLEVELAND TWIST DRILL CO.

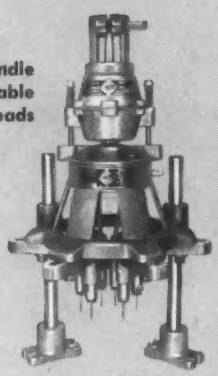
1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

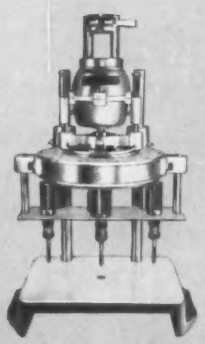
E. P. Barrus, Ltd., London W. 3, England



Fixed Spindle Multiple Heads



Flex-Shaft Spindle Adjustable Multiple Heads



Geared Spindle Adjustable Multiple Heads

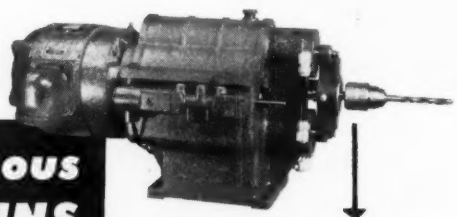
Unit engineered for greater small hole drilling and tapping production!

ETTCO-EMRICK MULTIPLE HEADS

BOTH the head and workholder are designed *as a unit* to your requirements to give you a *complete* high production system capable of maintaining highest production rates on your drill press. Thus, you are not only assured of drilling and tapping the maximum number of holes at each stroke but — what is just as important — the fastest handling of the parts.

SEE FOR YOURSELF. Send samples or drawings of your parts with basic production data. We'll give you recommendations and prices.

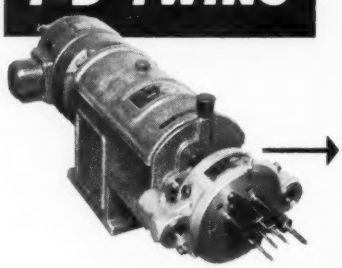
For details, ask for our Multiple Head Bulletins.



The famous T-D TWINS

Automatic Drilling Unit

Completely self-contained with exclusive features that mean better work at lower cost.



Automatic Lead Screw Tapping Unit

Used with Ettco-Emrick Multiple Heads, it's the ultimate in fast, automatic precision tapping.

"See your Authorized Ettco Distributor"

ETTCO TOOL CO., Inc.

592 Johnson Ave. Brooklyn 37, N. Y.

Chicago • Detroit • Los Angeles • Indianapolis

Ettco-Emrick the right equipment for every small hole drilling and tapping need.

INCREASE GEAR SHAVING OUTPUT *with* VERSATILE SEMI-AUTOMATIC LOADING

The operator handling a conventional rotary gear shaving machine is required to make 7 separate motions for each work part shaved.

With semi-automatic loading this is reduced to just 3 operations.

1. **Place work gear on the pre-locator.**
2. **Press the start button.**
3. **Remove the shaved gear.**

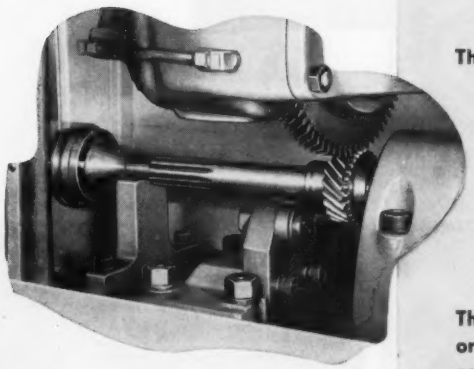
The rest of the cycle is automatic.

Results are:

- **Higher production**
- **Lower machining costs**
- **Less operator fatigue**
- **All the versatility of conventional shaving**
- **Greater safety**
- **Operator has ample time to serve 2 or more machines**

The approximate work locater and head and tailstock centers or plugs are the only work part changes that are additional to a conventional gear shaver.

Red Ring Shaving Machines, Models GCU and GCI may be equipped with this equipment.



Write for Estimated Savings on Your Particular Operation.

Plastic Splash-Guard Used for Demonstration Only.

NATIONAL BROACH & MACHINE CO.

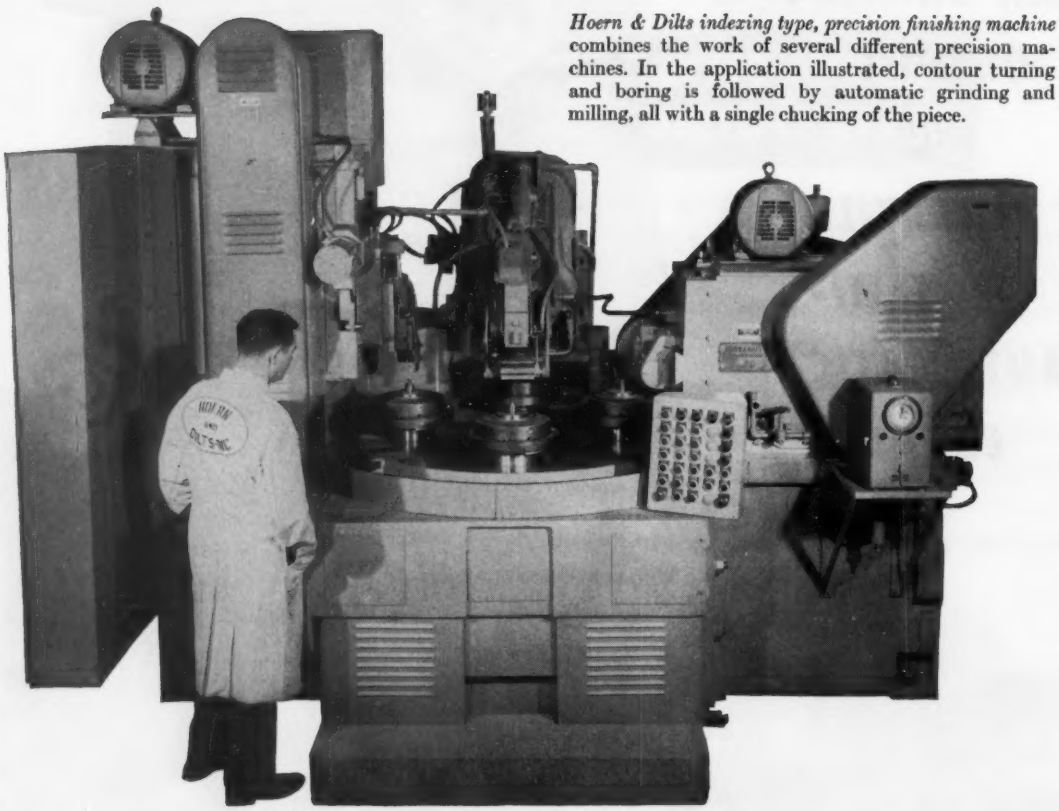
5600 ST. JEAN • DETROIT 13, MICHIGAN

7388

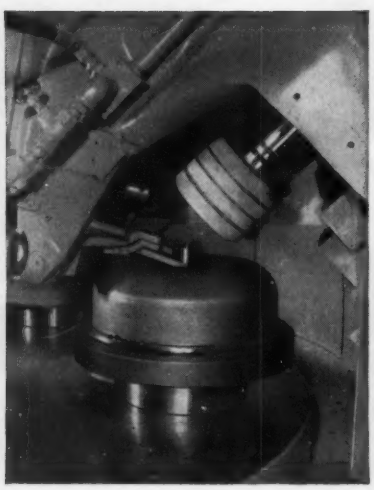
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

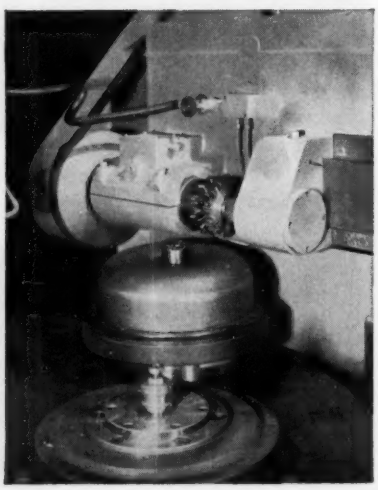
Hoern & Dilts, Saginaw, Michigan

THE NEW BRITAIN



Hoern & Dilts indexing type, precision finishing machine combines the work of several different precision machines. In the application illustrated, contour turning and boring is followed by automatic grinding and milling, all with a single chucking of the piece.





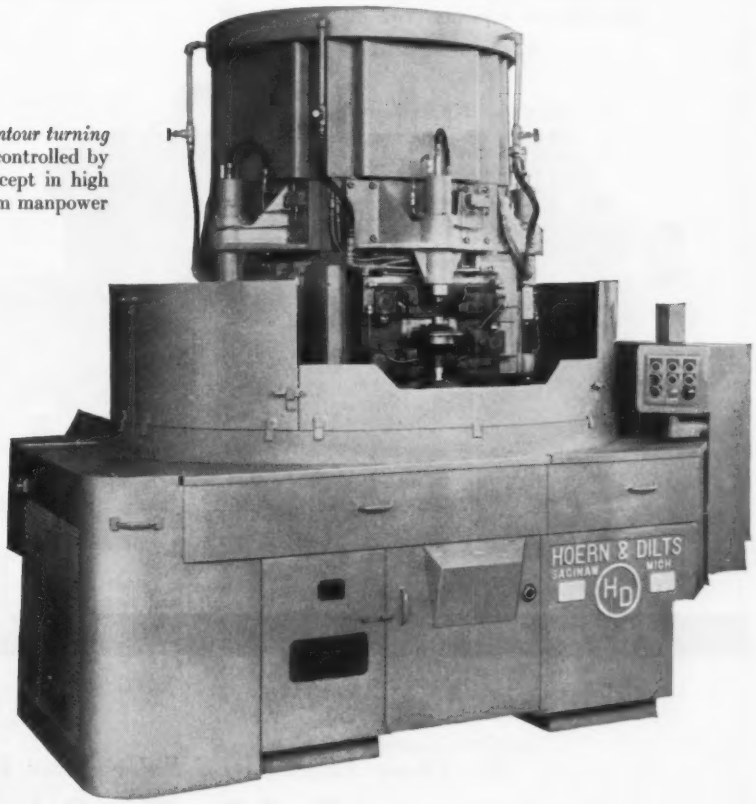
becomes a division of
MACHINE COMPANY

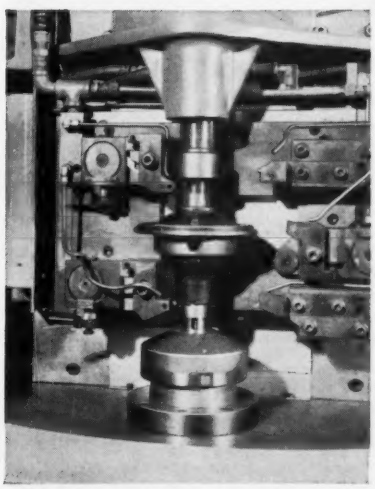
In ten years Hoern & Dilts has become a leader in developing machines for increasing productivity-per-man—by duplicating *the same* operation on five or ten spindle continuous machines, or by performing many *different* operations on multiple column indexing machines.

Now the extensive engineering and manufacturing resources of The New Britain Machine Company are placed at the service of Hoern & Dilts customers.

Write The New Britain Machine Company, Hoern & Dilts Division, Saginaw, Michigan, or consult your New Britain representative for information and literature.

Hoern & Dilts continuous type precision contour turning and boring machine. Five sets of spindles controlled by a single set of cams introduce a new concept in high production of precision pieces . . . maximum manpower utilization without operator fatigue.



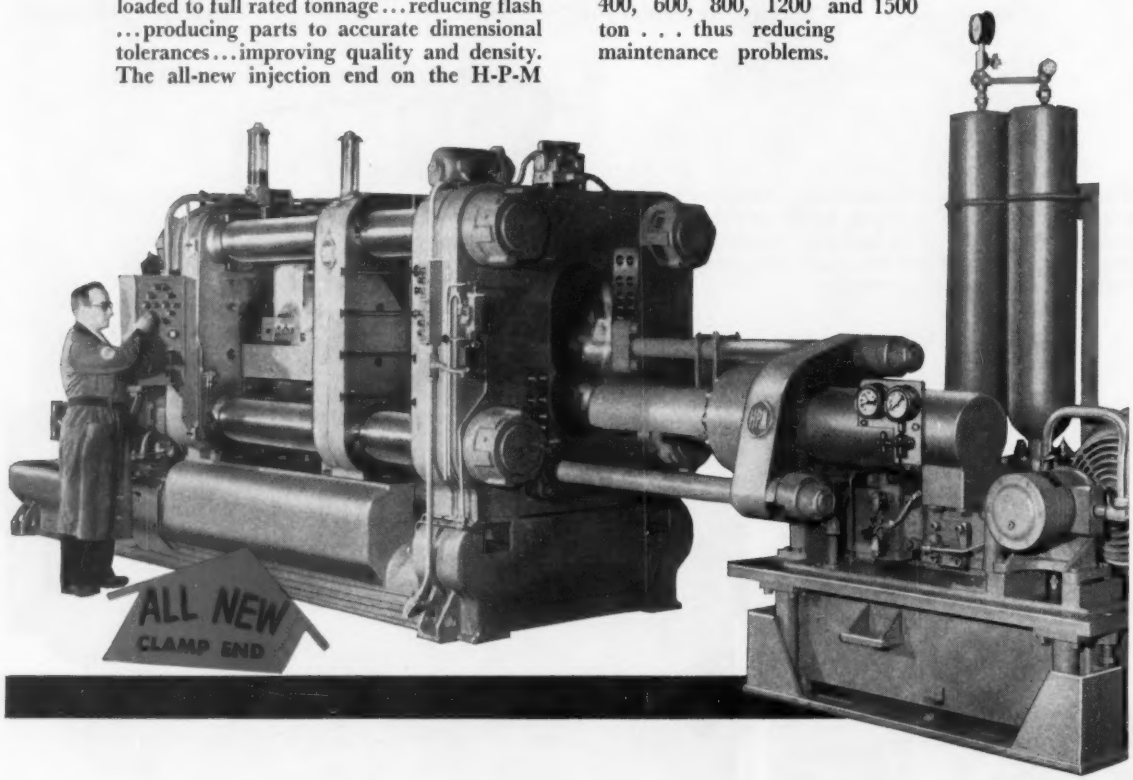


HOERN & DILTS
Saginaw, Michigan
A DIVISION OF
THE NEW BRITAIN MACHINE COMPANY

first all-new die casting

Backed by one year's field performance plus four years' research and development.

All new—from stem to stern—that's H-P-M's Die Casting Machine. Result? Better die castings for you. H-P-M's new exclusive mechanical link-wedge lock is the heart of the new design. There's plenty of "beef" in locking and frame members. The clamp is preloaded to full rated tonnage... reducing flash ...producing parts to accurate dimensional tolerances...improving quality and density. The all-new injection end on the H-P-M die caster is based on entirely new theories of metal injection pioneered by H-P-M. You benefit from a more compact unit plus greater dependability and closer control of hydraulic action. Design is standard on all six sizes — 200, 400, 600, 800, 1200 and 1500 ton . . . thus reducing maintenance problems.



Do These FEATURES Solve Your Problems?

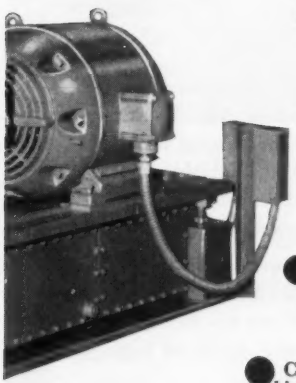
We Believe They Do!

- Positive, self-compensating lock to the rated tonnage or better . . . high mechanical advantage from flat-faced wedges and knuckle joint links.
- Less die flash . . . plenty of "beef" in rods, platens, locking mechanism . . . large bearing areas—low bearing load.
- Complete manifolding of all high-pressure hydraulics.
- No tie rod nut adjustment . . .push-button control for central screw daylight adjustment . . . easy die set-up and tonnage control.
- Maximum speed and pressure cycles through ample horsepower.
- Electric-hydraulic safety interlock . . . control of stroke, slowdowns . . . automatic cycling including three core pull sequence . . . complete flexibility of operation.

machine in 15 years

ALL NEW
INJECTION END

- A completely self-contained unit . . . not dependent on clamp end for operation.
- Independent injection end permits generous open floor area for automatic ladling furnaces and devices.
- Positive pressure follow-through with no delay . . . injection pressures to 30,000 psi . . . no need for auxiliary intensifiers.
- Injection speeds up to 1,000 feet per minute with ASME coded 2500 lb. accumulators.
- Complete control, through special valves, for any distance—speed curve.
- Complete manifolding of all high-pressure hydraulics . . . no swivel joints or hose.
- Flexible injection stroke for control of metal volume and cover die thickness.



Here's "blue chip" acceptance!

Westinghouse Electric Corp.

Leland Electric Co.

Ajax Die Casting Co.

Midwestern Die Casting Co.

W. L. Chapman Co.

Fabricast Division, G. M. C.

Kiekhaefer Corp.

The Hoover Co.

Price-Pfister Brass & Mfg. Co.

Char-Lynn Co.

Mall Tool Co.

Hamilton Die Casting Co.

Kiowa Corporation

Globe Imperial Corp.

☐ Send Complete Information
☐ Have Engineer Call

Name_____ Title_____

Company_____

Address_____

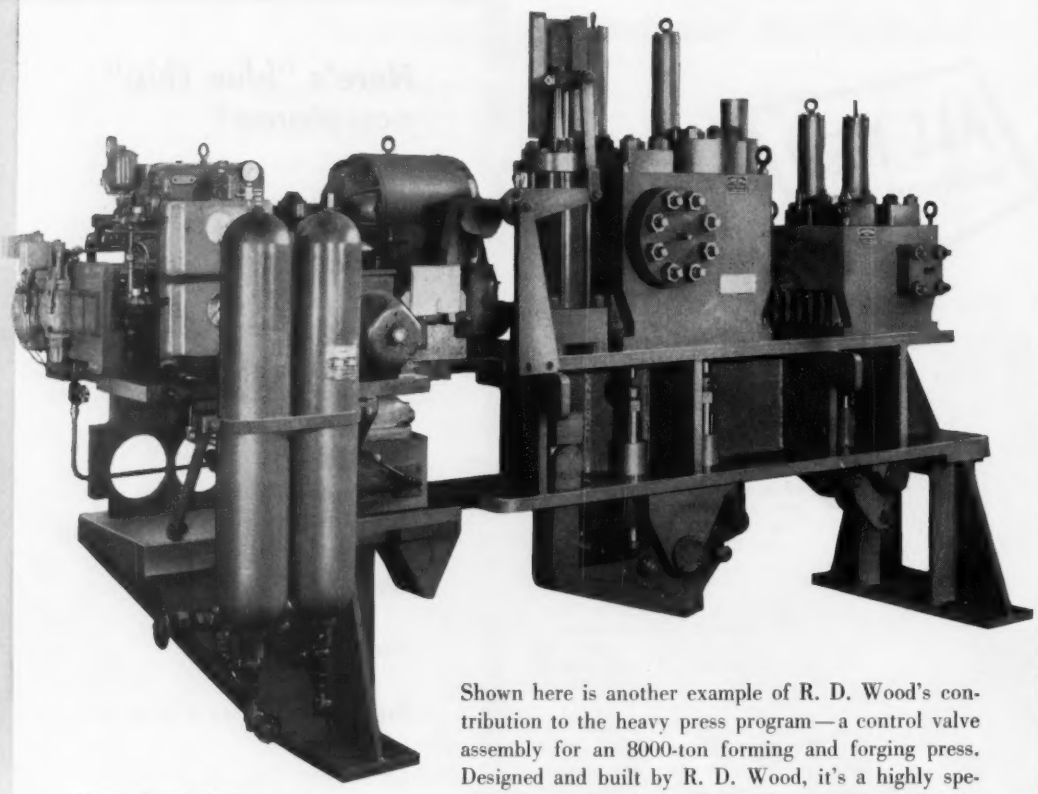
City_____ Zone____ State_____

HPM

DIE CASTING DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio U.S.A.

For more information fill in page number on Inquiry Card, on page 229

Big help in heavy press program



Remote electro-hydraulic servo control valve assembly. Length is 14 feet; height 9 feet.

Shown here is another example of R. D. Wood's contribution to the heavy press program—a control valve assembly for an 8000-ton forming and forging press. Designed and built by R. D. Wood, it's a highly specialized type. It indicates R. D. Wood's ability to handle the most difficult valve engineering and manufacture.

Other standard R. D. Wood high-pressure hydraulic valves include stop, operating, check, relief, and safety types. Since 1803, the name R. D. Wood has stood for superior products. Write for details on R. D. Wood high pressure hydraulic valves for every purpose.

R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING • PHILADELPHIA 5, PENNSYLVANIA

Representatives in Principal Cities

MAKERS OF HYDRAULIC PRESSES AND VALVES

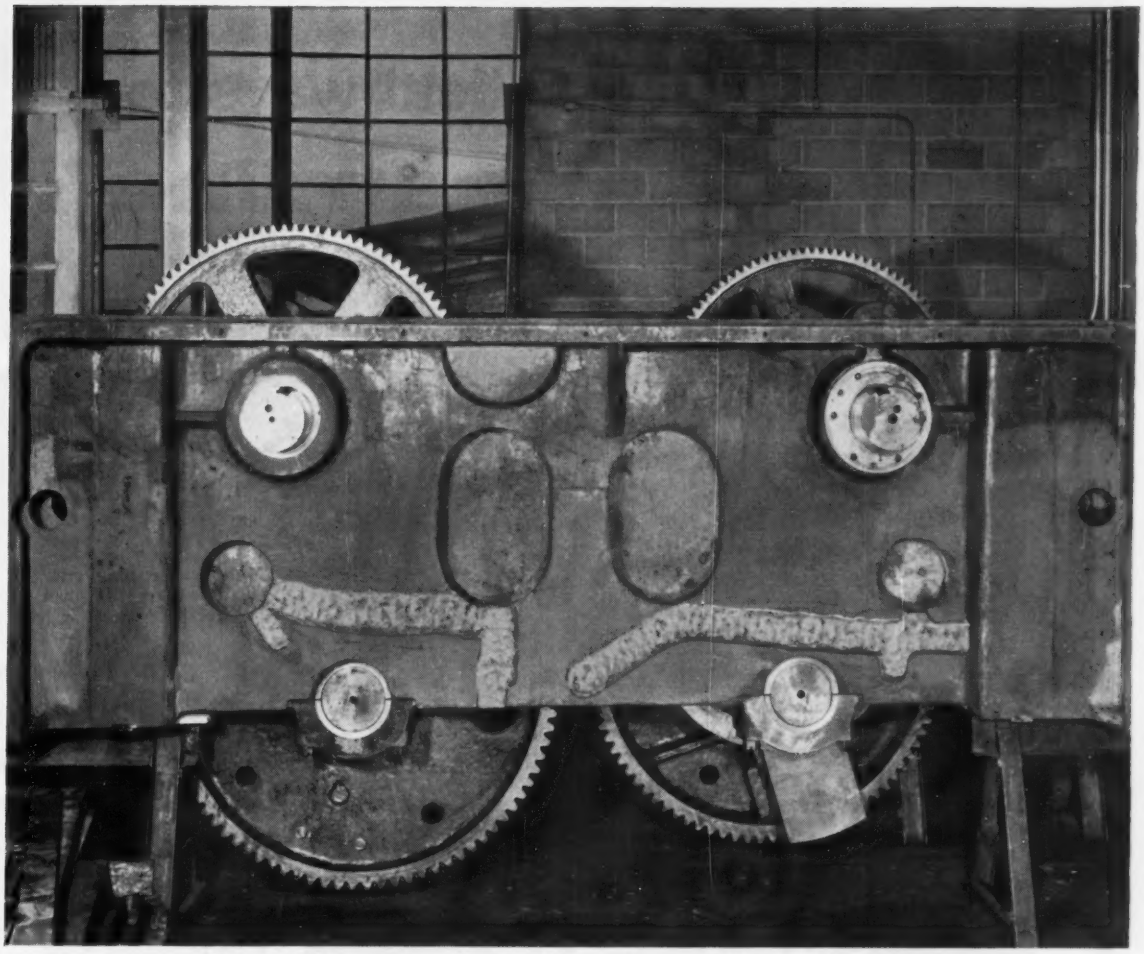
FIRE HYDRANTS

CAST IRON PIPE

GATE VALVES

GAS PRODUCERS

ACCUMULATORS



Two of the braze welds made in this big press crown with ANACONDA-997 (Low Fuming) Bronze Rod. All four cast-iron partitions in the crown were repaired.

After other repairs failed, Braze Welding with Anaconda Rod restored this iron press crown

When this 16-ton crown of a double-action press first failed, it was repaired by electric arc-welding using a high-strength nonferrous electrode. This joint failed.

The Punch Press Repair Corporation of Ferndale, Mich., cut out the old welds and braze welded all four of the cast-iron partitions in the crown, using a total of 800 pounds of 3/8" ANACONDA-997 (Low Fuming) Bronze Welding Rod.

Its useful life extended, the press is back in active service at the plant of a large tool and die firm in Detroit.

ANACONDA-997 (Low Fuming) Bronze is a superior welding rod used to join gray and malleable cast iron, steel, and copper alloys by the oxyacetylene process. It is one of a broad line of Anaconda Welding Rods that are finding increasing applications in production and repair welding. Anaconda Welding Rods are sold by distributors of welding equipment everywhere.

See your Anaconda distributor or write: The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

56109

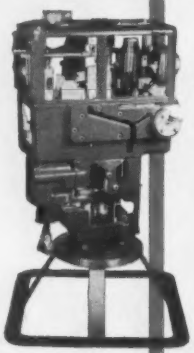
ANACONDA® WELDING RODS

Sold by distributors of welding equipment everywhere

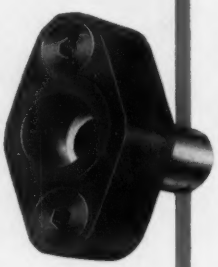
For more information fill in page number on Inquiry Card, on page 229

5 practical ways to "streamline"

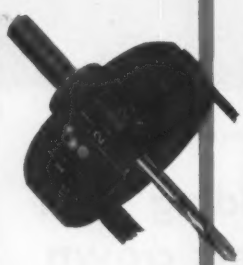
...without sacrificing fastening strength



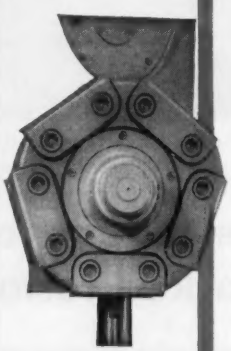
1. Counterbored holes are the simplest approach to flush surfaces using standard socket cap screws. The advantage of specifying genuine Allen O Head Cap Screws is the greater strength of Allenoy steel... you can use smaller sizes for closer spacing and reduced weight. Call on Allen, too, for *very large* socket-head, precision cap screws — up to 2½ inch diameter.



2. Countersinking enables you to get absolutely smooth external surfaces using Allen O Flat Head Cap Screws. Allen O Cap Screws feature the exclusive Leader Point which makes screw starting easier and guards against thread damage.



3. Button Head Cap Screws produce snag-free unbroken surfaces where countersinking is impractical. Button-head hex sockets are necessarily shallow. In genuine Allen O Button-Head Cap Screws, sockets are cold forged without broaching, in extra strength Allenoy steel... essential protection against stripping the sockets under high torque pressure.



4. A ready made hole tapped in forged steel solves many a design problem. It's called the Allenut. It can be anchored in soft material to assure durable threading, or recessed to permit tightening with an Allen Hex Key.

5. Bright finish, or rust and corrosion resistance call for Allen O Stainless Steel Cap Screws. They are standard stocked items (both NF & NC threads) readily available in a wide range of sizes from Allen Distributors.

YOUR ALLEN DISTRIBUTOR can give you practical help and swift service. For complete information on any technical fastening problem, write our engineering department direct.

ALLEN

ALLEN HEAD

MANUFACTURING COMPANY

Hartford 2, Connecticut, U.S.A.

For more information fill in page number on Inquiry Card, on page 229

continuous *Backbone* teeth...

give *you* these advantages...

Added strength, plus increased load-carrying capacity in smaller space result from the famous "backbone" construction of these gears (formed where the helices meet), where the full face width of each gear tooth is put to work. Because the continuous teeth of all Phillie Gear herringbones are accurately generated on the most modern machines, these gears assure smooth, continuous and highly efficient gear operation . . . year-in and year-out.

If you have a problem involving high horsepower speed reduction under heavy shock loads, specify Phillie Gear Continuous Tooth Herringbones, and be assured of quiet, vibration-free, long-lived transmission of power, for both speed reducing and speed increasing applications.

Learn more about these outstanding gears by requesting Catalog # G-655.

phillie gear

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.

Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID AGITATORS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.

For more information fill in page number on Inquiry Card, on page 229

WIN a 2-weeks LUXURY

All Expenses Paid,

LAST CHANCE TO *ENTER!* JONES &

NEW HORIZONS

Grand Prize:

Two-Weeks Luxury Vacation Trip for Two, All Expenses Paid, to a choice of one of the following: Paris, Hawaii, The Caribbean, The Canadian Rockies, Plus $400 for spending money, baby sitter fee, etc.

Two 2nd Prizes: Each a Seven-Day All-Expenses-Paid Luxury Vacation for Two to Bermuda. Plus $200 spending money.

Three 3rd Prizes: Each a Shopmaster Combination Saw-Jointer Power Tool, complete with motor.

Ten 4th Prizes: Each a Shopmaster Individual Single-Purpose Power Tool (A Choice of Saw, Drill Press, Jointer, etc.)

Jones & Lamson, famed for opening up NEW HORIZONS in metalworking efficiency, now offers you, personally, NEW HORIZONS — a luxury vacation for two people for two weeks with all expenses paid, to your choice of Paris, Hawaii, The Caribbean or The Canadian Rockies.

Think of it — you can enjoy deluxe travel, finest hotels and accommodations, the very best of everything, plus $400 spending money. Live like a millionaire for two weeks, for just answering this question, "Which Jones & Lamson machine, or machine feature, could, or does, help you most, and Why?"

When you write in (use coupon or not, as you wish), we will send you an official entry form, together with information upon which to base your answer. So don't delay! Even if you've never entered any contest before . . . if you have a good idea and can express it clearly — *YOU* may win this glorious luxury vacation for two! And don't forget — there are other prizes! — two deluxe 7-day all-expenses-paid vacations for two to Bermuda, and 13 prizes of famous Shopmaster home workshop Power Tools! Enter *today!* Read the simple rules, and send in this coupon *NOW!*

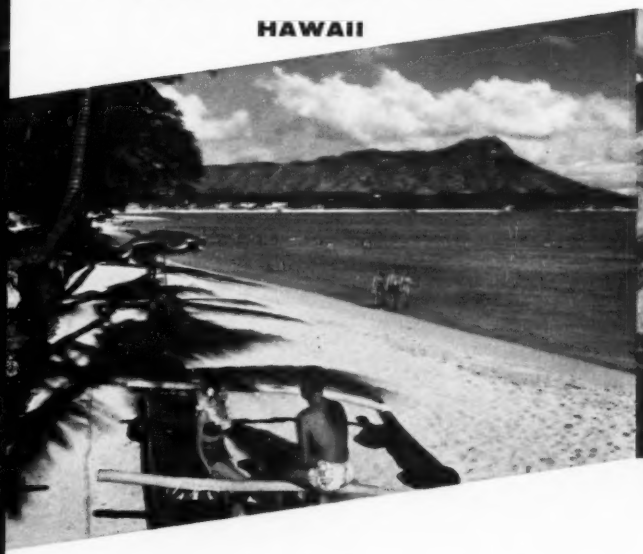
J&L JONES & LAMSON MACHINE COMPANY

512 CLINTON STREET, SPRINGFIELD, VERMONT

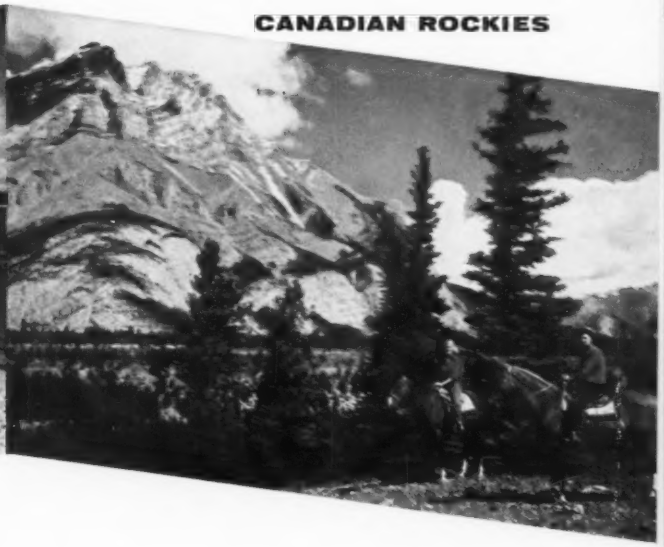
VACATION FOR TWO!

to your choice of . . .

HAWAII



CANADIAN ROCKIES



LAMSON'S CONTEST

CONTEST RULES

Contest is open to all persons, residing in the continental U. S. A., engaged in metalworking or allied industries, except employees of Jones & Lamson Machine Company, its selling agents and its advertising agency, and members of their families.

Contestants merely answer, in 150 words or less, the question "Which Jones & Lamson Machine, or Machine Feature, could, or does, help you most, and Why?"

Entries are to be mailed to Jones & Lamson NEW HORIZONS CONTEST, Box 364, Back Bay Annex, Boston 17, Massachusetts.

Entry must be contestant's own, and must be handprinted or typed on an official Jones & Lamson NEW HORIZONS CONTEST entry form. Entry forms that are not completely filled out will be disqualified. Entry forms filled out in handwriting will also be disqualified. No entries will be returned, and all entries become the property of Jones & Lamson Machine Company.

The submitting of a contest entry implies the contestant's agreement with and submission to all contest rules. Contest entries must be postmarked by midnight July 10, 1956 and received by July 20, 1956.

Board of Judges will include machine tool engineers, production foremen, business executives, trade publication editors, and an engineering college faculty member.

Judges' decisions are final. Entries will be judged for aptness of thought, originality and sincerity. "Literary style", as such, will *not* be a deciding factor. Elaborate or "fancy" entries will receive no extra consideration.

Winners will be announced in Jones & Lamson Machine Company advertisements in trade publications as soon as possible after the judging of the contest.

Easy to Enter! You Could Win!

JONES & LAMSON MACHINE COMPANY
512 Clinton Street, Springfield, Vermont

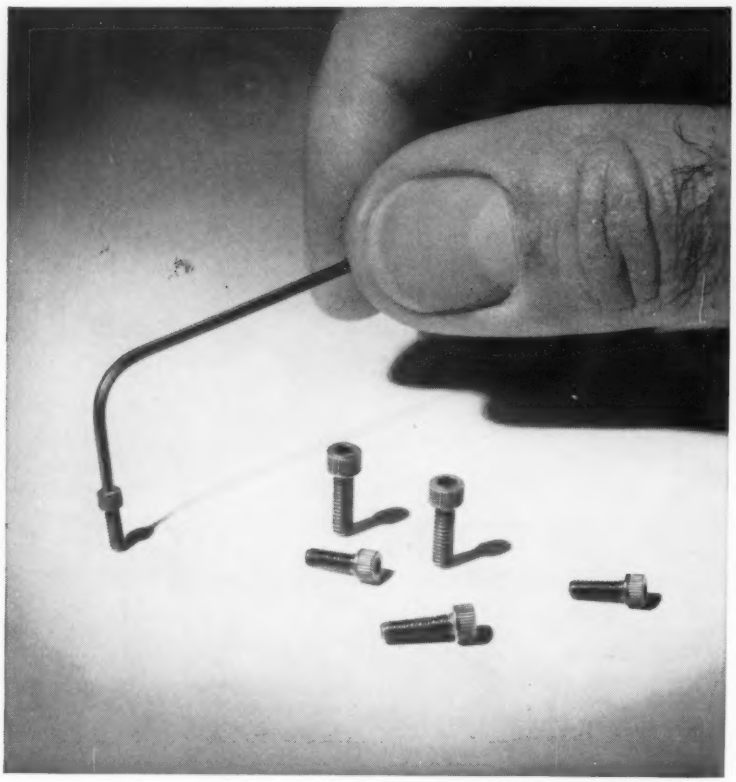
Please send official NEW HORIZONS CONTEST entry form and information to:

*Name*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

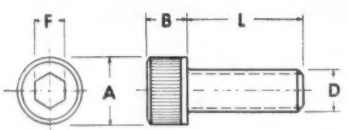
Miniature screws aid standardization of small devices



Standard UNBRAKO miniature socket head cap screws are available in sizes #0, #1, #2 and #3, in heat treated alloy steel or stainless steel, at your authorized industrial distributor's. Standard lengths range from ⅛ to ½ in.

HEAT-TREATED ALLOY STEEL

Class 3 Fit Standard



	Diameter	Threads per Inch NC	Threads per Inch NF	Length	Recommended Installation Torque in Inch-Pounds NC	Recommended Installation Torque in Inch-Pounds NF	Weight per 1000 in Pounds
#0	A .104		80	⅛		2.0	.152
	B .060		80	3/16		2.0	.182
	D .060		80	¼		2.0	.210
	F .050		80	⅜		2.0	.265
#1	A .118		72	⅛		3.5	.27
	B .073		72	3/16		3.5	.32
	D .073		72	¼		3.5	.37
	F .050		72	⅜		3.5	.47
#2	A .140	56		3/16	6.0		.42
	B .086	56		¼	6.0		.50
	D .086	56		⅜	6.0		.58
	F 1/16	56		½	6.0		.70
#3	A .161	48		3/16	8.5		.59
	B .099	48		¼	8.5		.70
	D .099	48		⅜	8.5		.81
	F 5/64	48		½	8.5		1.03

Tiny close-tolerance Unbrako screws available in standard sizes

New economies in the design of space-saving miniature equipment are possible with these UNBRAKO miniature socket head cap screws. Manufactured to timepiece precision, available locally, they save the costly necessity of designing special screws to fasten tiny parts in compact units. They're ideal for use in typewriters, calculators and computers, servomechanisms, electric and electronic equipment—and in countless other small, intricate devices where maximum reduction in bulk and weight is required with no sacrifice in strength of individual components or assemblies.

Fingers grip the knurled heads on these tiny screws positively for easy handling and fast assembly. Uniform hex sockets assure maximum wrenching torque. Controlled fillets under the heads prevent shearing of the heads. Threads are fully formed for maximum strength and exact fit. Extremely accurate head diameters permit their use in countersunk holes, saving weight by reducing the length of the screw required and making flush designs possible.

These standard UNBRAKO miniature screws are available at your authorized industrial distributor's. See him today. Or write us for Bulletin 2055 and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 19, Pa.

Standard Screws are threaded to the head. Special materials, lengths, and threaded lengths are available. One "High-Titan" UNBRAKO hex key is included with each package of 100 screws.

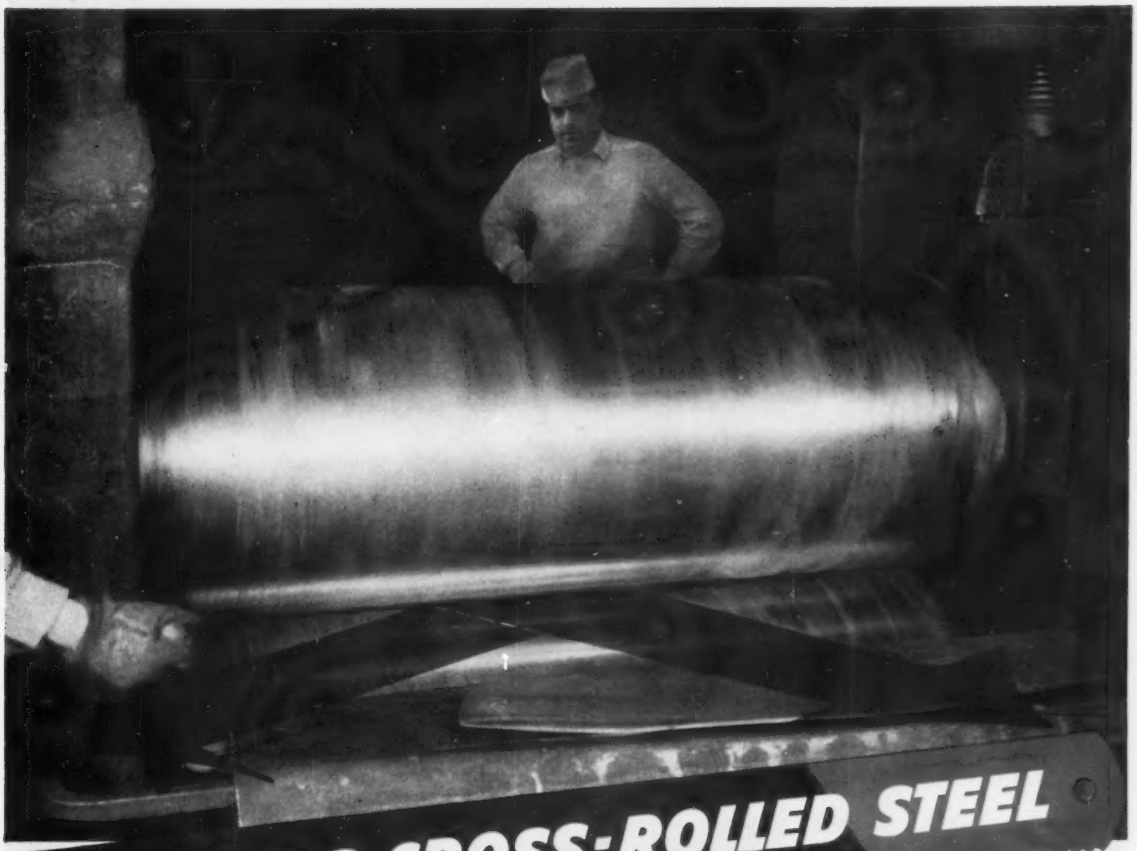
UNBRAKO®

SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

sps

JENKINTOWN PENNSYLVANIA



SIMONDS CROSS-ROLLED STEEL

Makes a Simonds hacksaw blade last longer!

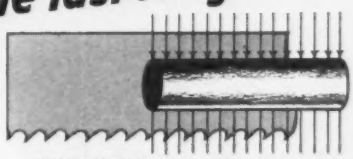
Look for ... ask for the blade with the "RED END"

Test after test proves that Simonds "Red End" Hack Saw Blades last uniformly longer. One reason is Simonds *cross-rolled steel* . . . steel that has a more uniform grain structure for added toughness.

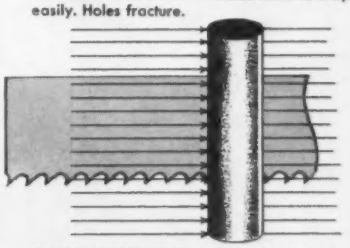
Another reason is Simonds own high quality steel — made especially for hack saw blade use.

Add to this Simonds improved method of tooth setting . . . and Simonds more uniform heat treating . . . and you've got the reasons why Simonds "Red End" Hack Saw Blades last longer, give more cuts per blade, cost less to operate.

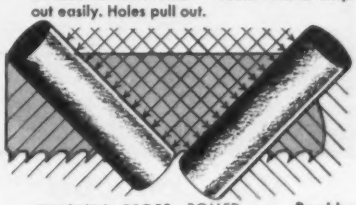
Furnished in all standard lengths and tooth sizes for hand and power use with a choice of High Speed MOLYBDENUM; High Speed TUNGSTEN; WELD-EDGE (High Speed Shatterproof); and STANDARD STEEL (Hand Blades only).



ROLLED WIDTH-WISE — Blade tends to snap easily. Holes fracture.



ROLLED LENGTHWISE — Teeth tend to strip out easily. Holes pull out.



SIMONDS CROSS-ROLLED — Provides toughest grain structure for longest life and resistance to breakage.

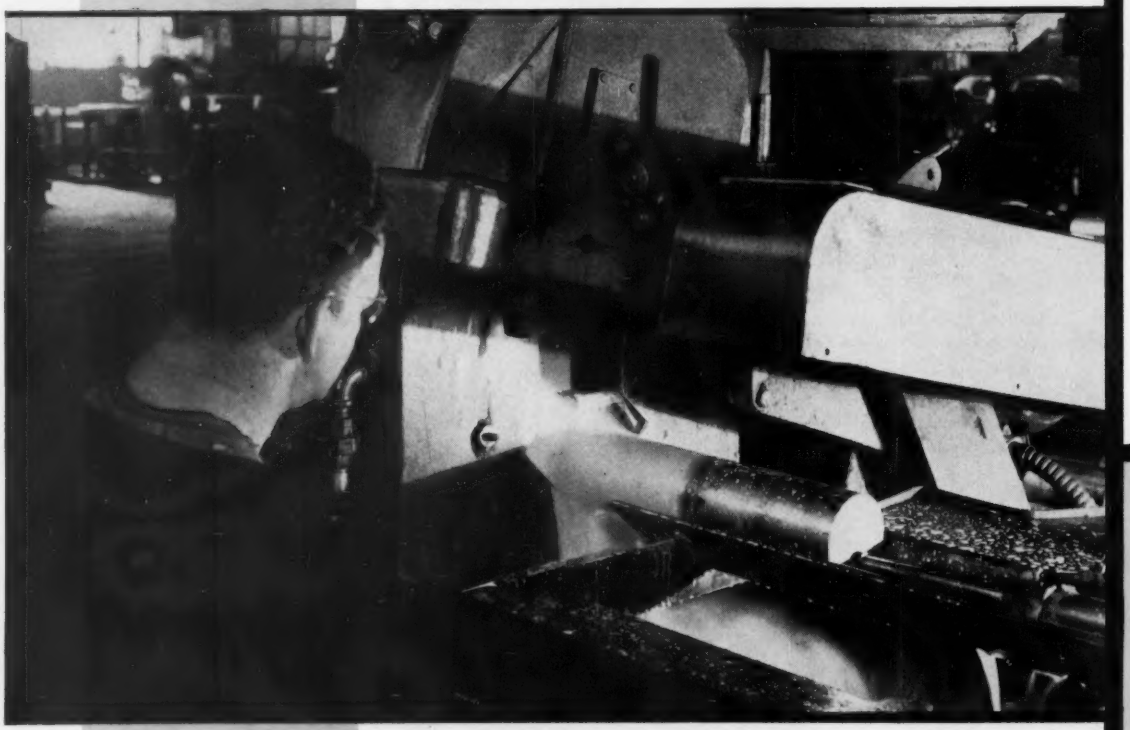
For Fast Service from Complete Stocks
Call your
SIMONDS Industrial Supply DISTRIBUTOR

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon
Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.
Heller Tool Co., Newcomerstown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

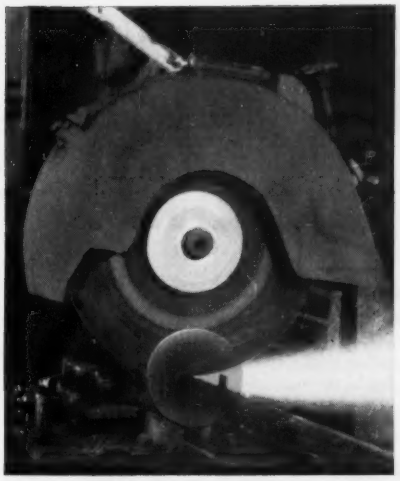
B9 RESINOID CUT-OFF WHEEL

The B9 is an ideal high production wheel, adaptable to speeds up to 16,000 sfpm. Available with either smooth sides, or with the rougher "F" sides for greater chip clearance. An exceptional performer on both ferrous and non-ferrous metals. For dry cutting only.



R50 RUBBER CUT-OFF WHEEL

Designed primarily for wet-cutting metal bar stock, the Norton R50 rubber bonded wheel handles diameters up to 6". Built-in chip clearance — unusual in this type of wheel — is an advantage for freer, cooler cutting, with minimum burr and without case hardening the work. Can also be used for dry cutting.



Three for thrift!

Norton cut-off wheels . . . fast, safe and long-lasting . . . bring you the profit-boosting "TOUCH of GOLD"

Norton has brought cut-off wheel development to the point where you can be sure of fast, clean cutting action, low rate of wear and a wide safety margin on every job.

That goes for all metals, from softest to hardest — for non-metals ranging from rubber hose to marble — and for any type of machine, high speed or low speed, swing frame, chopper, traverse, floor stand or portable.

Three of the most popular Norton cut-off wheels are shown here. See your Norton Distributor for practical help in wheel selection and facts on dry vs. wet methods for your cutting-off operations. Or write to the nearest District Office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

W-1702

BN RESINOID CUT-OFF WHEEL

Extra strength and safety, plus knurled sides for more effective cutting action, make the reinforced, resinoid bonded BN wheel a great favorite for the widest range of jobs, especially non-ferrous operations. Other uses include: cutting wire rope; slotting railway track welds; tuck pointing; cutting fibre board, concrete, tile, plastics, and the like.

NORTON

ABRASIVES

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives Sharpening Stones • Behr-Cat Tapes

"Buffalo"

BUILDS THE

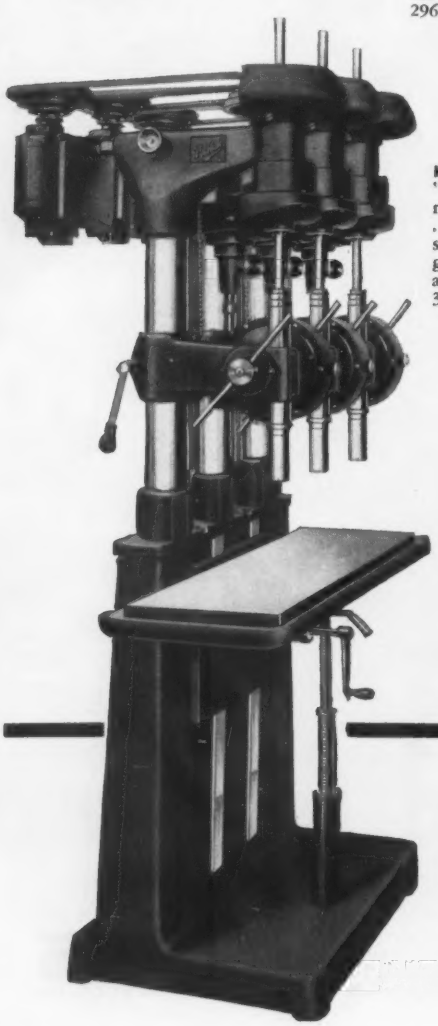
TO MEET YOUR MOST

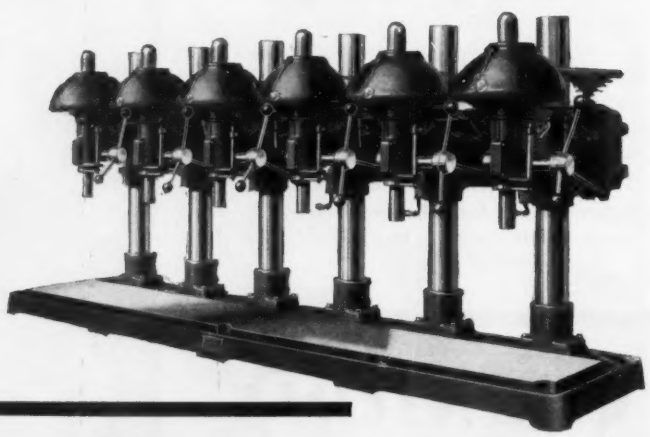
HIGH-SPEED PRECISION PARTS DRILLING—"Buffalo" No. 14 Drills are high-speed, precision machines with capacity from the smallest commercial drill sizes up to ⅜". Spindles are alloy steel with adjustable alloy steel sleeves for lasting accuracy. Full range of single or multiple bench or floor models. Write for Bulletin 2730G.

⅞" CAPACITY DRILLING—SENSITIVE OR POWER FEED—There's no better value in a ⅞" drill than the "Buffalo" No. 161 In 8", 12" or 15" overhangs with speed range from 400 to 3000 r.p.m. Round column, floor type, bench and pedestal models, 1 to 6 spindles. Top grade machines for easy operation and long life. Write for Bulletin 2730G.

RUGGED ½" JOB AND PRODUCTION DRILLS—"Buffalo" No. 15 Drills are built for heavy production work, with full strength and rigidity. Extremely wide choice of models—tapping and slow speed attachments, tilt tables, radial drills, bench and floor single and multiple spindle models. Write for Bulletin 2963G.

HEAVY-DUTY PRODUCTION DRILLING UP TO 1"—"Buffalo" No. 18 Drills are built in a choice of 19 models to meet the most particular requirements . . . choice of feeds and table arrangements . . . 1 to six spindle models, bench and floor types. Precision ground spindles of chrome-nickel alloy with adjustable sleeve bearings for lasting accuracy. Bulletin 3123.





ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

BUFFALO

440 BROADWAY

Canadian Blower & Forge

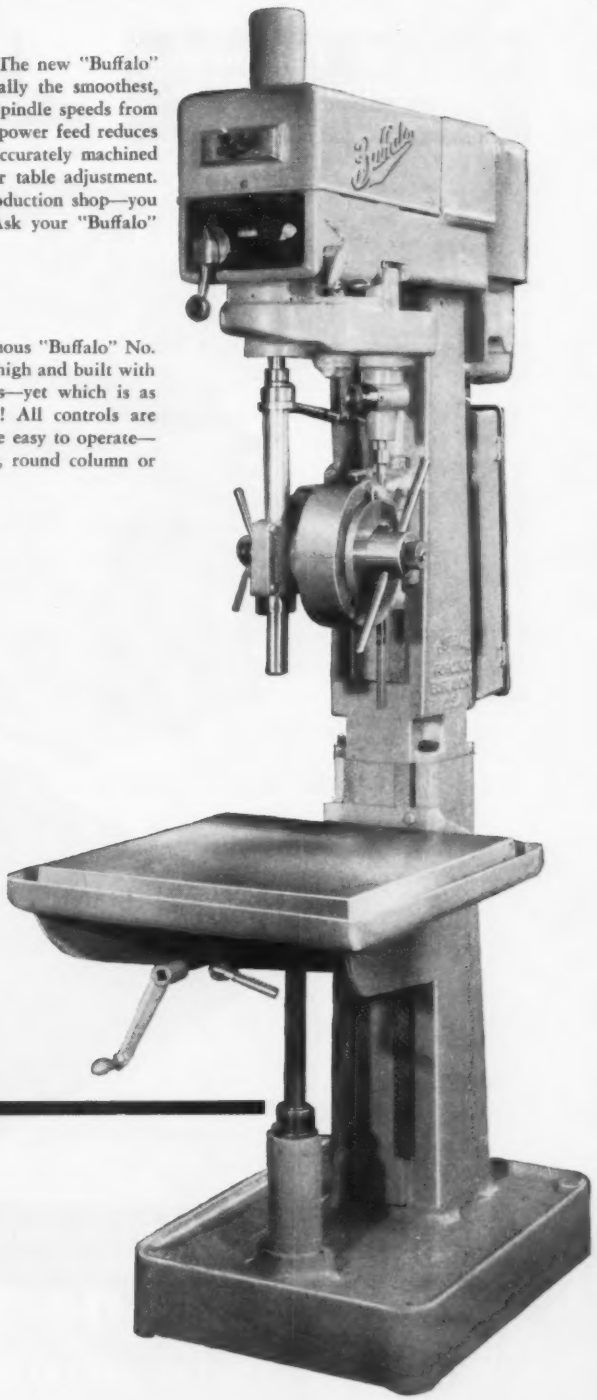
DRILLING • PUNCHING

HIGH-OUTPUT DRILL

PARTICULAR REQUIREMENTS

THE DRILL WITH "EVERYTHING" FOR HIGH OUTPUT—The new "Buffalo" RPMster with adjustable-speed gearless drive is literally the smoothest, most convenient drilling machine you ever operated! Spindle speeds from 100 to 3,000 r.p.m. are adjusted in seconds. All-geared power feed reduces operator fatigue and margin of error. All parts are accurately machined and precision fitted. Ways are hand scraped for easier table adjustment. Here is the ideally accurate time-saver for the high-production shop—you have to see and operate this machine to believe it. Ask your "Buffalo" Machine Tool Dealer for details and demonstration!

LARGE CAPACITY—HIGH PRODUCTION—Here's the famous "Buffalo" No. 22 Drill with capacity up to 1½" drills—standing 96" high and built with all the strength and rigidity this heavy work requires—yet which is as easy to set up and operate as small, sensitive drills! All controls are within easy reach. All table and head-raising screws are easy to operate—all ways are hand scraped. Choice of 1 to 4 spindles, round column or pedestal. Write for Bulletin 2989G.



FORGE COMPANY

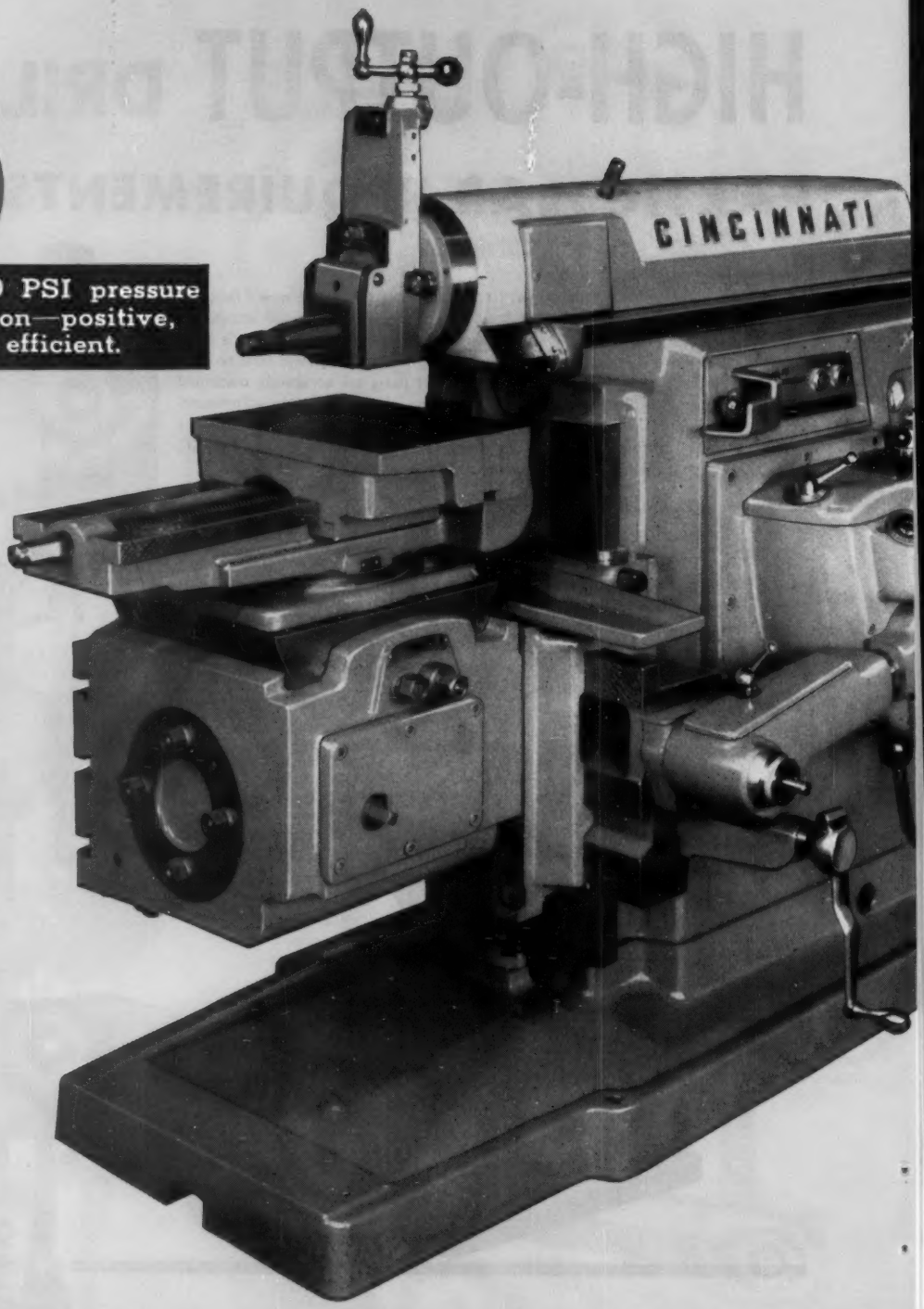
BUFFALO, NEW YORK

Co., Ltd., Kitchener, Ont.

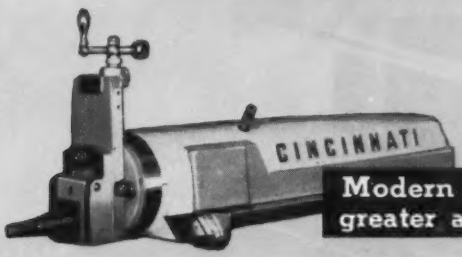
SHEARING • BENDING

For more information fill in page number on Inquiry Card, on page 229

Modern 50 PSI pressure lubrication—positive, safe, efficient.



Modern brushless electro-magnetic brake and clutch—no adjustment required.



Modern nodular iron slot-free ram for greater accuracy.

CINCINNATI RIGID SHAPERS

Rigidity thru advanced design of column, ram, vise and trunion permit smooth heavy cuts on these modern Cincinnati Rigid Shapers.

The most modern controls and oiling system give speedy performance and easy and positive operator control.

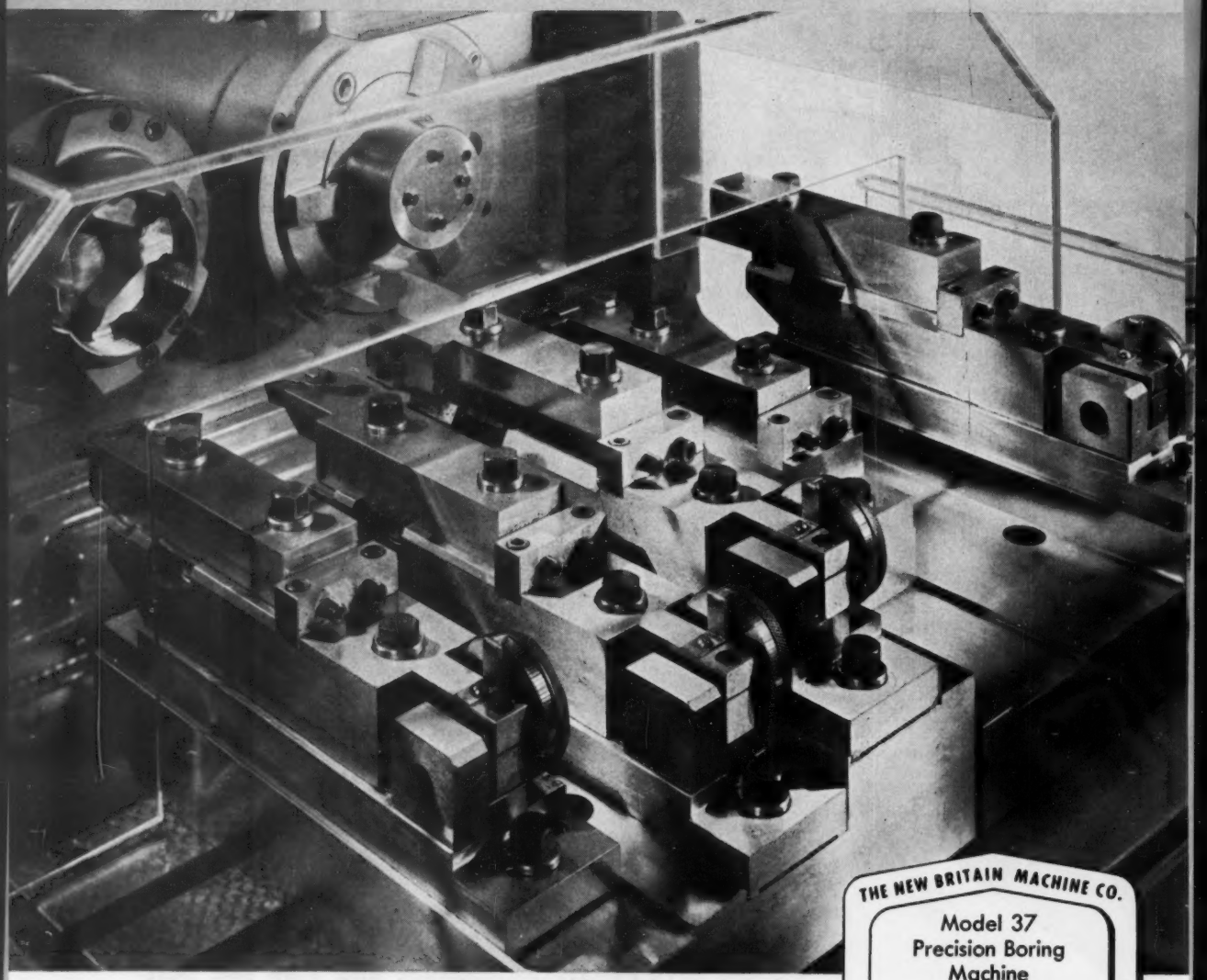
Furnished in 16″ to 36″ capacities.

WRITE FOR THE NEW DESCRIPTIVE BULLETIN.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI



THE NEW BRITAIN MACHINE CO.

Model 37
Precision Boring
Machine

NB

your most solid investment in precision boring machines

New Britain boring machines employ super-precision spindles and positive cam control of all tool paths. Both the spindles and the cam shaft are solidly mounted to the rugged frame to protect the original high accuracy for the life of the machine.

Available with either single or multiple spindles. Hopper feed, automatic gauging and tool resetting may be added. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

old methods can't compete

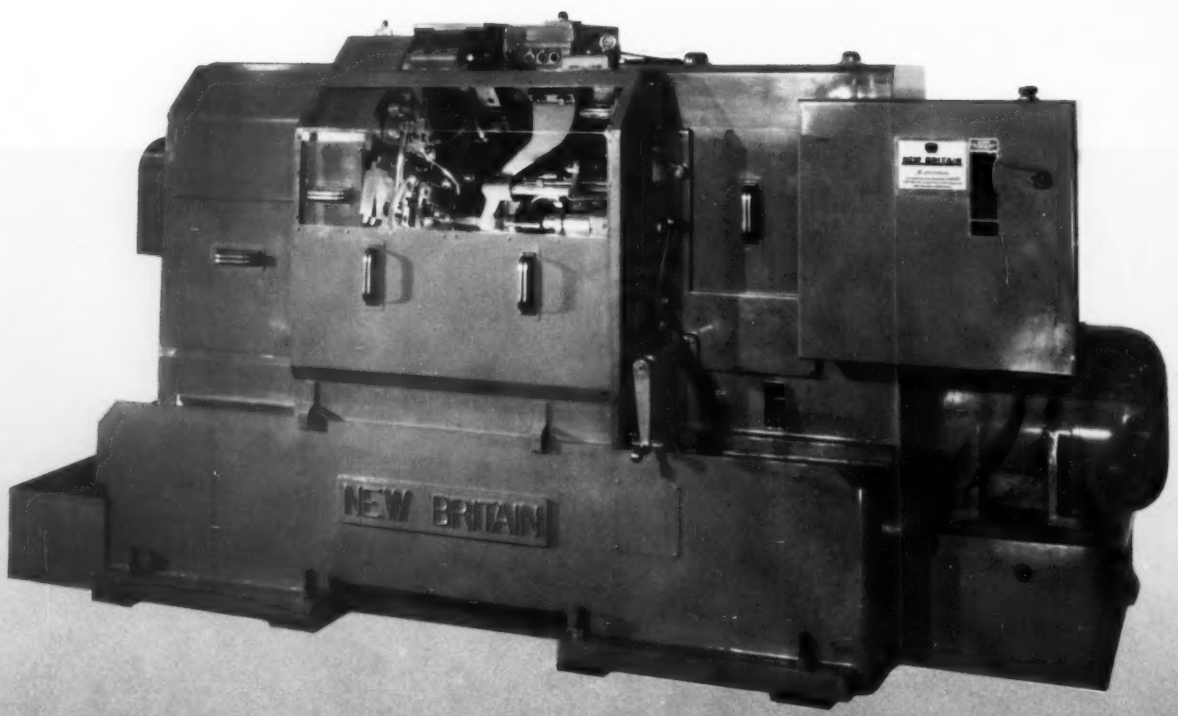
If you do *any* turning you should investigate the New Britain **+GF+** line of copy turning lathes—whether your work calls for sustained production or short runs demanding quick setups. It turns tapers and complicated contours with the same setup used for simple O.D.'s. No need for expensive form tools. Let us demonstrate this completely different approach to turning in a color motion picture demonstration at your desk.

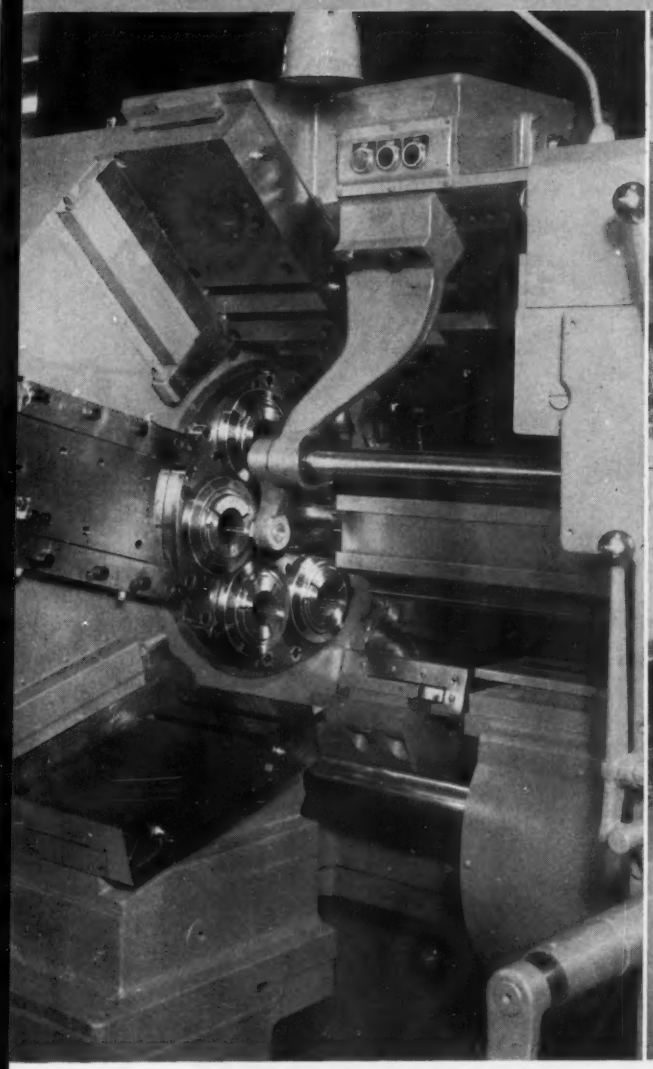
THE NEW BRITAIN MACHINE CO.
Model 11/70
New Britain +GF+
Copying Lathe
NB

a long new step forward in bar machine productivity

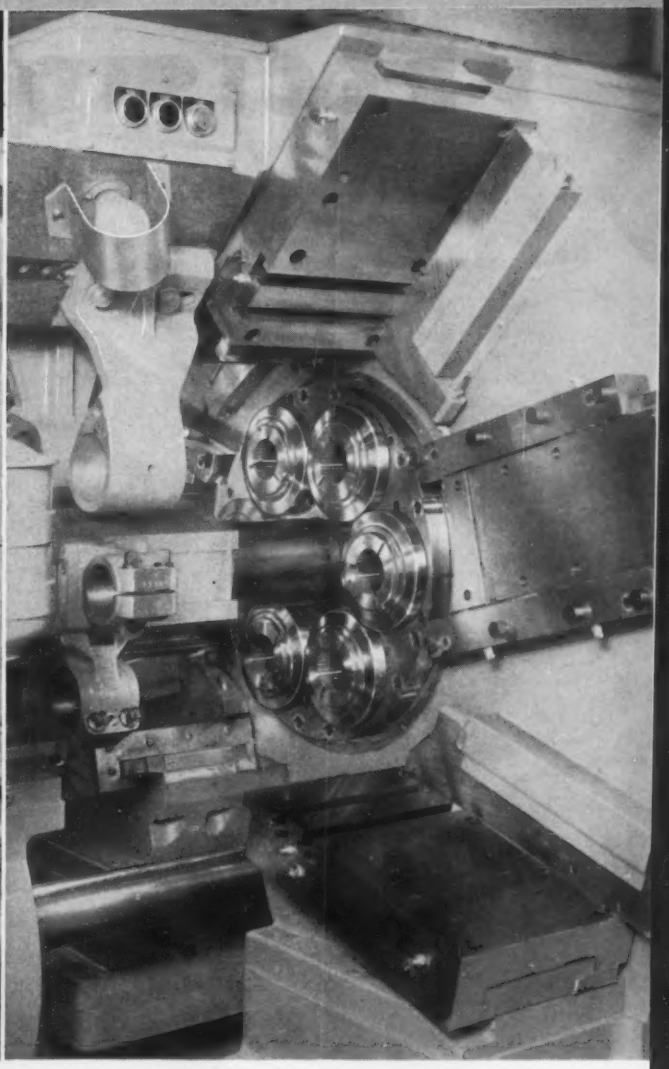
THE NEW BRITAIN MACHINE CO.
Model 62
Automatic Bar
Machine
NB

Here is a new New Britain bar machine with the ruggedness, power, speed and versatility to shed new light on your profit picture. Where you have bar work that now requires more than one machine, it may be practical to eliminate costly finishing operations by doing the whole job on a New Britain Model 62. Ask your New Britain representative or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.





Tooling area, front of Model 62



Tooling area, back of Model 62

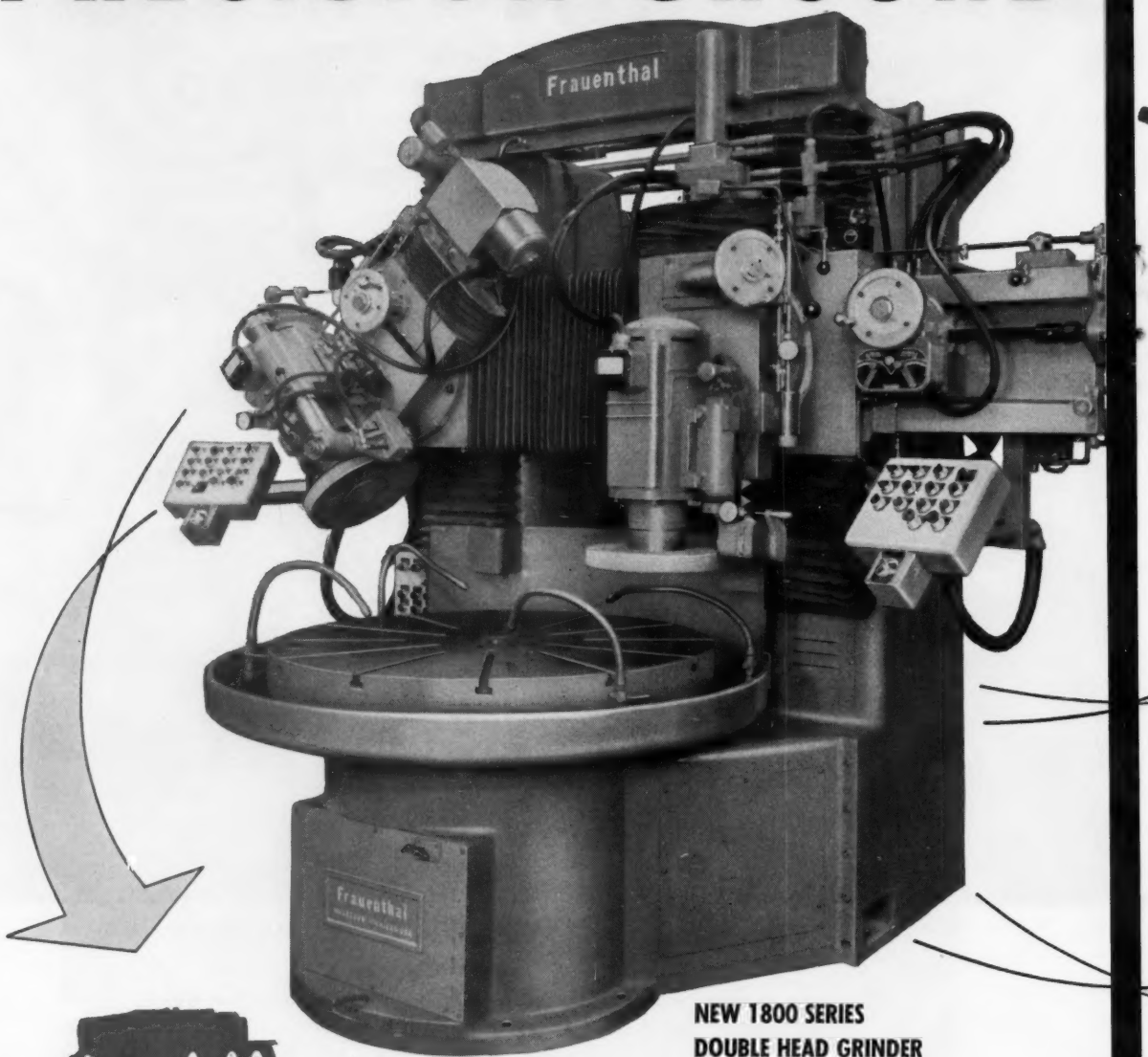
This new automatic combines the most important features for which New Britains are noted, with many basic improvements:

- Spindle carrier lifting to eliminate wear.
- Carrier locating and locking for uniform accuracy and rigidity.
- Spherical roller collet closing mechanism.
- Automatic stop.
- More efficient spindle spacing.
- An independent cross slide in every position.
- Maximum tool clearance.
- Improved accessibility to tooling area and cutting tools.

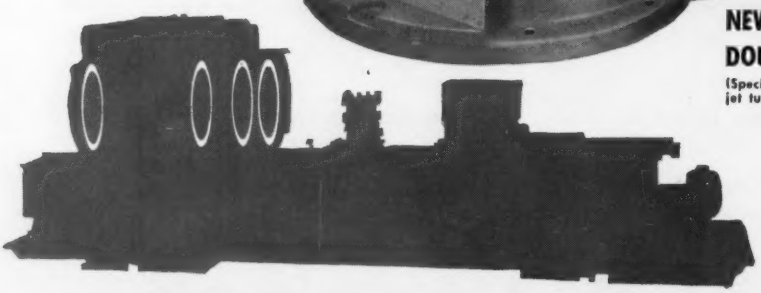
The NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division, New Britain, Connecticut

PRECISION-GROUND



NEW 1800 SERIES
DOUBLE HEAD GRINDER
(Specially equipped for grinding jet turbine blades)



MACHINE TOOLS

Free Catalog!

For complete details on Frauenthal 1800 Series Double Head Grinders, write for catalog.

Frauenthal Division

COMPONENTS . . .

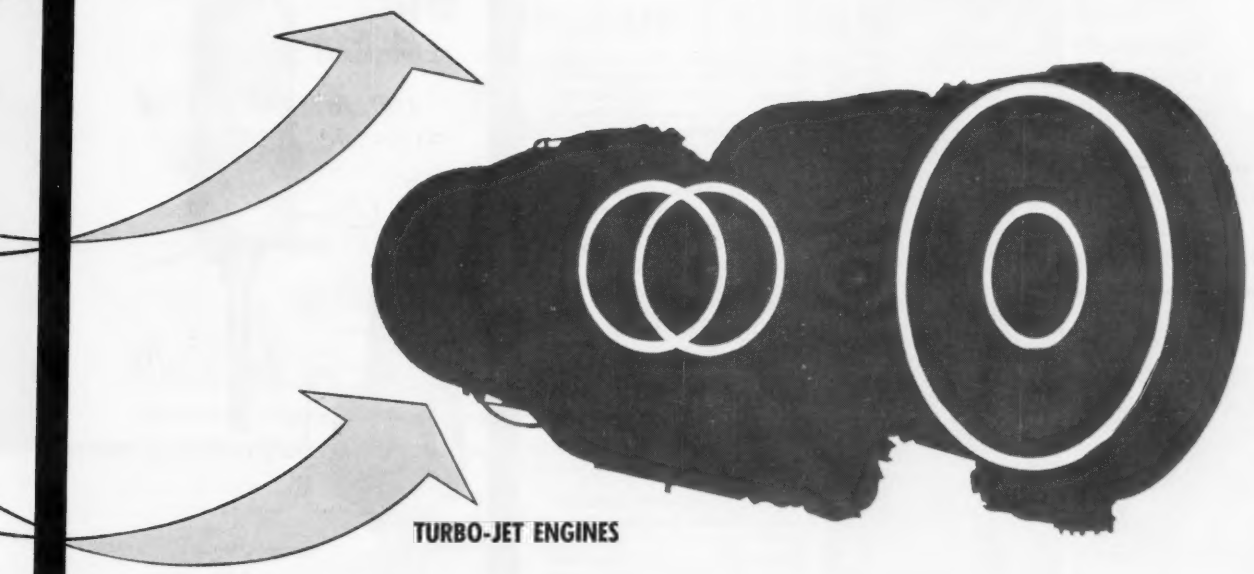
ORDNANCE

WHATEVER YOUR FIELD OF INDUSTRY — With Frauenthal precision machines, you're able to grind diameters and related surfaces without changing setup of the workpiece and obtain accuracies within .000200". This assures consistently uniform precision in concentricity, parallelism and roundness.

The accuracy and versatility of Frauenthal equipment is unequalled in the machine tool field. Difficult work-pieces — those impossible to handle on conventional horizontal grinding equipment — are handled with comparative ease on these unusual machines.

Four different series of machines are available affording table sizes up to 140". The 1800 Series Double Head Precision grinder, illustrated at left, is now available with a maximum swing of 72" and various table sizes to suit customer specifications.

For complete details, contact Frauenthal of Muskegon, Michigan.



TURBO-JET ENGINES

MACHINE TOOLS — Modern day machine tools are required to produce piece parts to greater accuracy than ever before. Therefore, machine tool components must be more precise to the nth degree. With Frauenthal grinders you can grind collets, chucks, spindle sleeves and similar components under simulated assembly conditions to assure concentricity, parallelism and roundness. Eliminate costly and time consuming hand scraping and grind plated parts prior to and after plating for increased wearability.

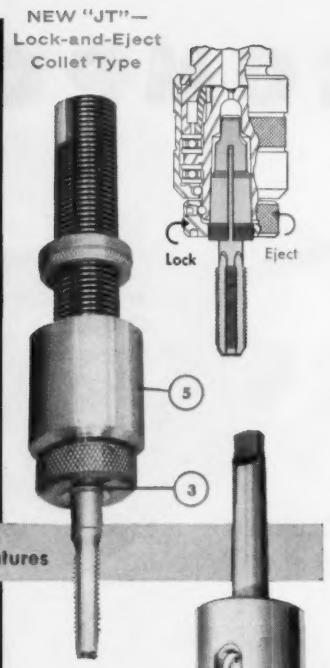
TURBO-JET ENGINES — Diffuser cases, rotors, compressor discs, vanes, etc., are components of jet engines ground on Frauenthal equipment. Thin section parts, which are unstable due to their design, are ground on the horizontal rotary table of the 1800 and 3100 Series machines. The compound and spindle angle setting features permit the grinding of surfaces normally inaccessible on conventional equipment.

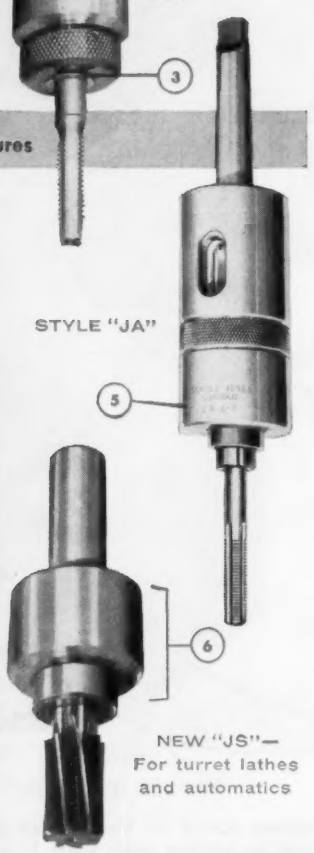
ORDNANCE — Large bearings and housing components for ordnance applications are ground on the 1800 and 2200 Series grinders. Applications vary from aircraft gun turret bearings to the large turret bearings required for tanks, motorized gun carriages, radar and naval gun mounts.

THE KAYDON ENGINEERING CORP.
MUSKEGON, MICHIGAN

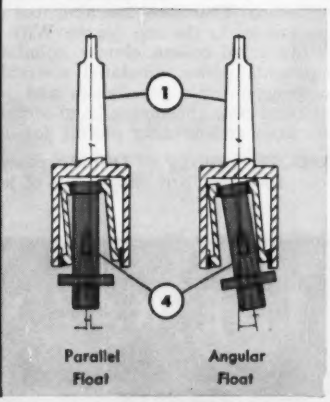
You buy Scully-Jones "PREMIUM FEATURE" FLOATING HOLDERS

AT NO PREMIUM IN PRICE!





These benefits . . .	for these reasons . . .	result from these PREMIUM features
HIGHER QUALITY WORK	No "binding" or dead spots to cause bell-mouthed, out-of-round, or poorly finished reamed holes. No oversized or tapered threads when tapping.	1. Exclusive double-gear spline drive provides a balanced, constant velocity, and a flexible drive coupling which permits freedom of lateral or angular movement.
LOWER CUTTING TOOL COSTS	No "cramping" to break fine cutting edges.	2. Two thrust bearings placed close together and independent of drive, as well as proper clearance in the spline, allow tool to float freely and quickly into proper alignment.
INCREASED PRODUCTION	Less downtime due to cutting tool breakage.	
	Tool changes are fast and easy.	3. New Lock-and-Eject Type Chuck (Style "JT" only) eliminates need for conventional-type drift.
LOWER MAINTENANCE COSTS	Positive, self-lubricating action practically eliminates wear.	4. "Rocking" action with spline drive coupling causes continuous flow of lubricant *in* and *out* of splines, and cushions drive against torsional shock and overload. Shell houses floating and driving elements, and acts as perfect seal for lubricant.
LOWER TOOLING COSTS	Holder may be used for most close-center and multiple-spindle operations.	5. Small body diameter.
	Requires little space between spindle and work.	6. Minimum body projection (Style "JT" and "JS").



SCULLY JONES

Call your Scully-Jones factory-trained representative or distributor for complete information and prices.

PRECISION HOLDING TOOLS

"Precision Holding" for holding precision

Scully-Jones and Company, 1906 South Rockwell Street, Chicago 8, Illinois

For more information fill in page number on Inquiry Card, on page 229

SIP

Guaranteed Accuracy

More and more manufacturers apply SIP *Guaranteed* Accuracy to define, establish and maintain high precision in production and measurement to improve quality-of-output and economy-of-operation.

NORTHERN ORDNANCE INCORPORATED

TEMCO AIRCRAFT CORPORATION

American Optical

Rheem AVIATION PLANT

National

Avey

SPERRY

IBM

CANADAIR — AIRCRAFT MANUFACTURERS —

Thompson Products, Inc.

MOTCH & MERRYWEATHER

Ford

LOCKHEED

Hamilton Watches

RENDA ENGINES

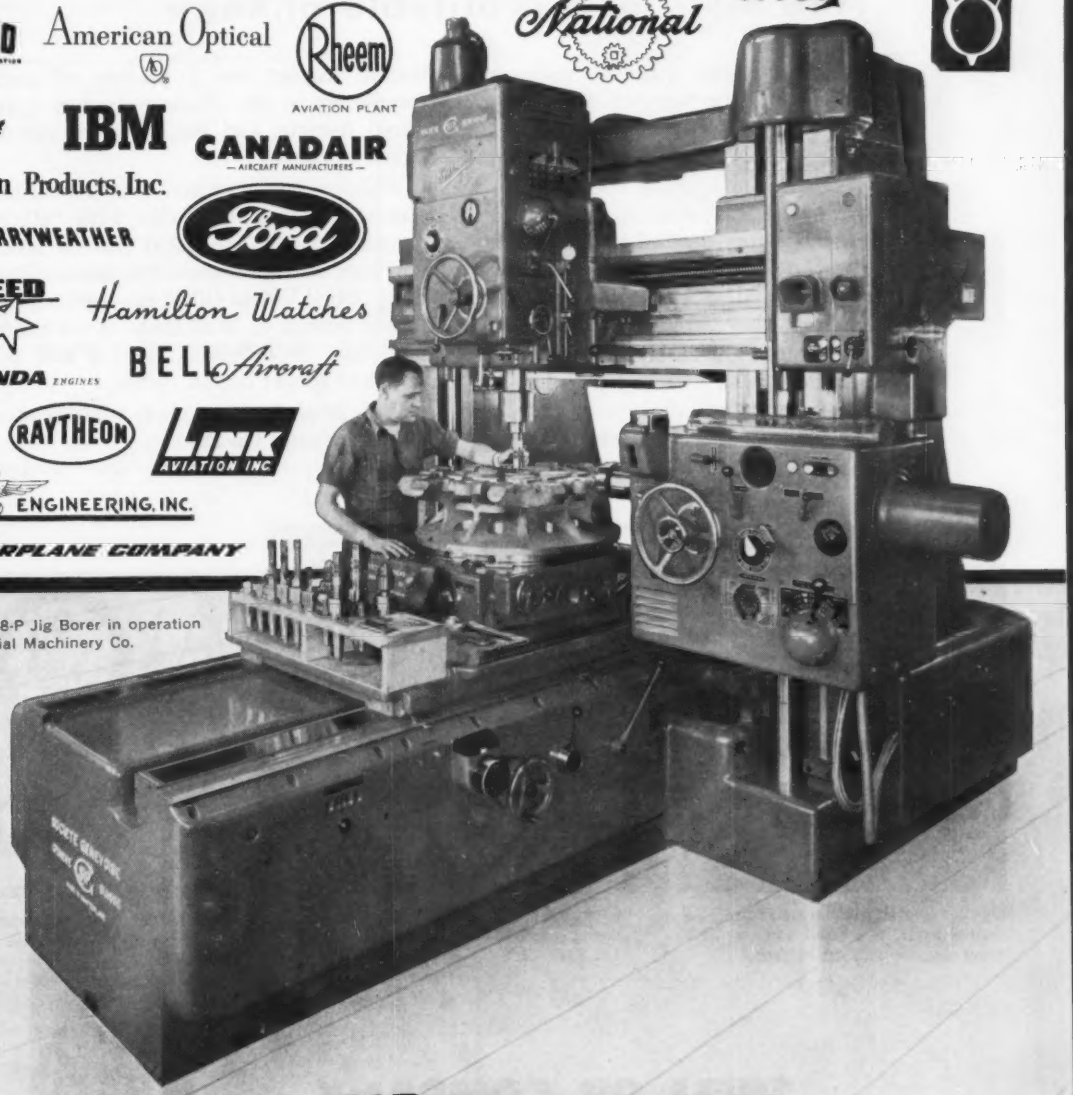
BELL Aircraft

RAYTHEON

LINK AVIATION INC.

Merz ENGINEERING, INC.

BOEING AIRPLANE COMPANY



SIP HYDROPTIC 8-P Jig Borer in operation at Hartford Special Machinery Co.

AMERICAN SIP CORPORATION

HIGH PRECISION MACHINE TOOLS & MEASURING EQUIPMENT

100 EAST 42nd STREET, NEW YORK 17, N. Y.

"The right quench oil for our work is

SHELL VOLUTA OIL 23"

says Garland Wilcox, Chief Metallurgist
Wallace Barnes Co., Bristol, Conn.

. . . the story of a profitable change

WALLACE BARNES COMPANY and steel springs have "gone together" for nearly a century. Most of today's output is in SAE 1075 or 1095 steel.

Because the quenching operation is so important to the life of springs, the Wallace Barnes laboratory decided to test its regular quenching oil against some of the newer products, including Shell Voluta Oil 23. This is what they found:

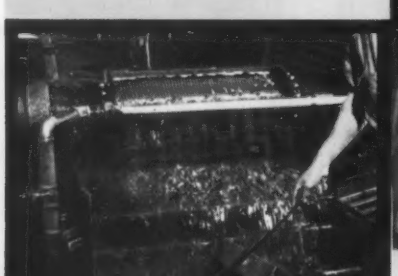
Shell Voluta Oil 23 showed a superior quench rate, with correct hardening and relative freedom from distortion. It drained more rapidly from the quenched parts, reducing dragout loss. It washed off more completely in the alkaline cleaner; it reduced flaming, and cut down on the oil baked to parts.

Wallace Barnes reports that this oil has almost eliminated trouble with "slack-quenched parts," and that heavier stock now goes through without special handling. So . . . Shell Voluta Oil 23 has replaced the former quench oil in all tanks of the spring hardening departments, serving salt pot lines and shaker hearth furnaces.

We'll be glad to provide full information on Shell Voluta Oil 23.

WALLACE BARNES CO.
A division of Associated Spring Corp.
Bristol, Conn.

Photos courtesy "STEEL"



Shaker hearth furnaces automatically dump parts into Shell Voluta Oil 23, then remove and drain them.

Flat springs at austenitizing temperature get a fast quench in Shell Voluta Oil 23.

Over 35,000 prints of production items like these are kept on file at Wallace Barnes Co.

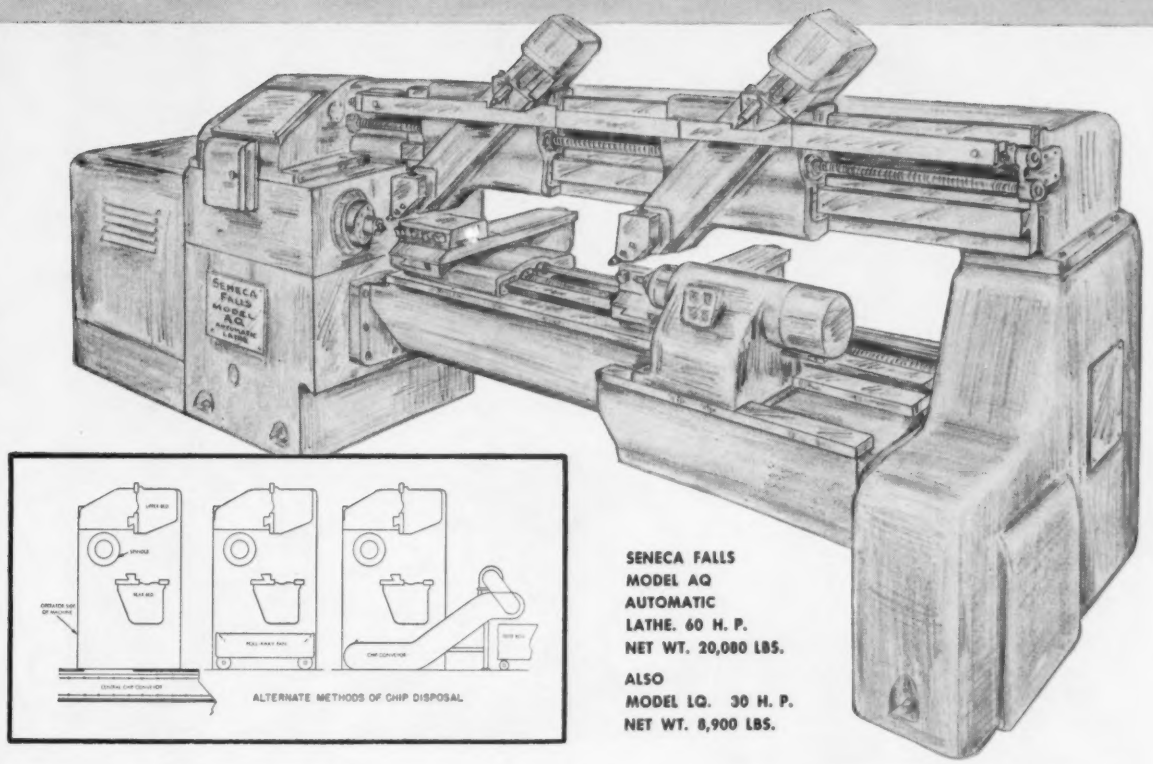
SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

For more information fill in page number on Inquiry Card, on page 229

A BETTER METHOD OF MACHINING REAR AXLE, AND OTHER SHAFTS



ALTERNATE METHODS OF CHIP DISPOSAL

SENECA FALLS
MODEL AQ
AUTOMATIC
LATHE. 60 H. P.
NET WT. 20,000 LBS.

ALSO
MODEL LQ. 30 H. P.
NET WT. 8,900 LBS.

● The new Models LQ and AQ Seneca Falls Automatic Lathes are designed to combine the best and fastest methods of rough and finish turning shafts on a single machine without removing the work and without attention on the operator's part.

The roughing operation is accomplished with multiple tools on a rear carriage while finish turning is done with single, tracer-controlled tools on each of the two overarm carriages. Thus the advantages of multiple tooling for stock removal and single tool tracer turning for accurate finish operations are combined. By this method extremely close tolerances are maintained since the pressure of the single tool is constant over the entire length of the work piece, and full advantage can be taken of the higher cutting speeds now possible with the newer carbide and oxide tool materials.

The machining operation is completely automatic . . . the operator loads shafts between centers and pushes the starting button; multiple tools rough turn; tracer tools then finish turn; and finally the machine stops with all tools returned to starting position.

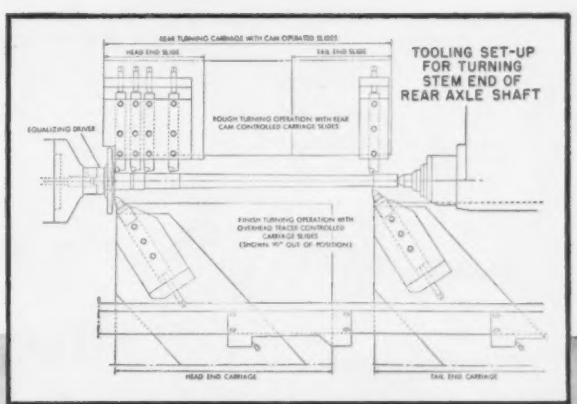
A similar type lathe is used for the flange turning operation. Varying application of multiple tooling or single tracers to either rear or overarm carriages is possible on these lathes and complete "in line" automation can be engineered to specific production requirements,

SENECA FALLS MACHINE CO., SENECA FALLS, N.Y.

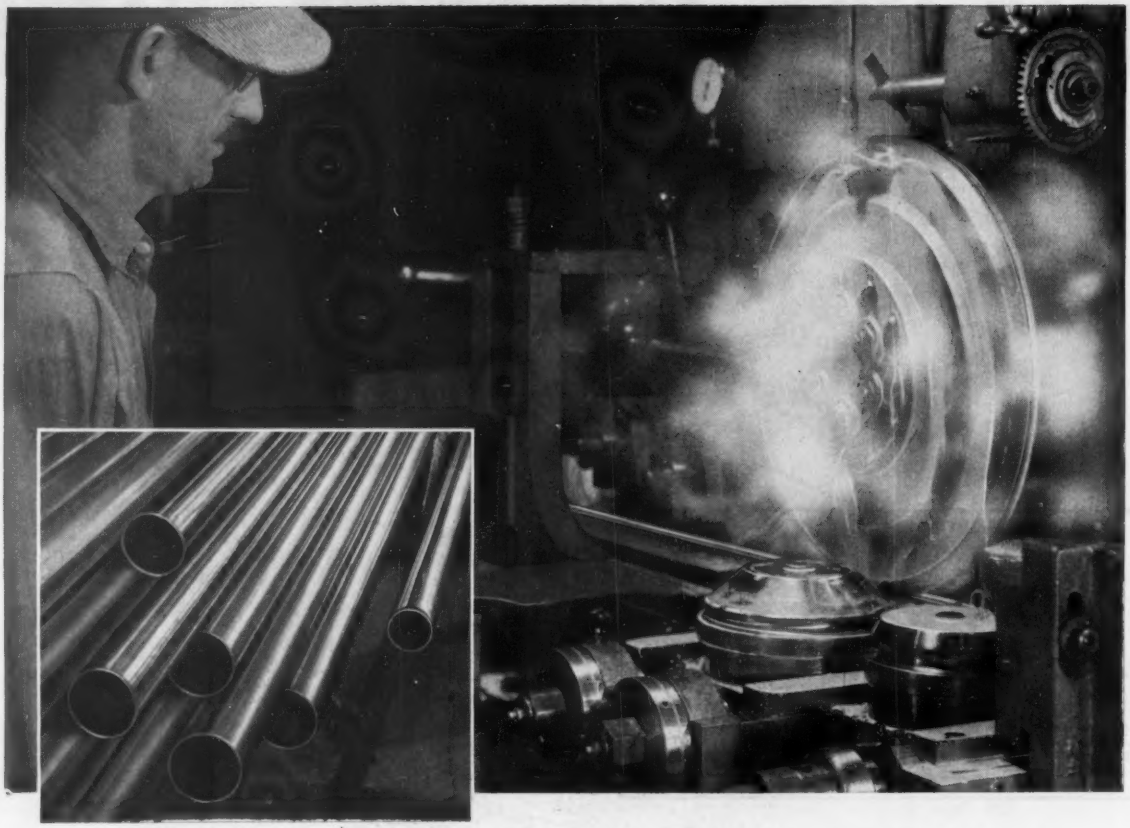
WRITE FOR BULLETIN AX 56B

DESIGN FEATURES

- **Simplified changeover features for reduced set-up time.**
- **Feed rate may be automatically changed during cutting cycle.**
- **Streamline design for efficient chip guarding.**
- **Screw feed to all carriages.**
- **Four speed head with automatic change-over.**
- **Large chip flow area.**
- **All templates clear of chip area.**
- **All ways hardened, ground and replaceable.**
- **Open front design facilitates loading and unloading.**
- **Straight line diameter adjustment for tracer tools . . . no shoulder length change to correct.**


TOOLING SET-UP FOR TURNING STEM END OF REAR AXLE SHAFT
EQUALIZING DRIVER
ROUGH TURNING OPERATION WITH REAR CAM CONTROLLED CARRIAGE SLIDES
FINISH TURNING OPERATION WITH OVERHEAD TRACER CONTROLLED CARRIAGE SLIDES (SHOWN 90° OUT OF POSITION)
HEAD END CARRIAGE
TAIL END CARRIAGE

NEW SENECA FALLS
MODEL LQ AND AQ AUTOMATIC LATHES



IN ELECTRIC-WELD PIPE AND TUBE MAKING

Yoder leads the way

to higher speeds and quality at lower cost

In the short period from 1938 to 1955, the production of electric welded pipe and tubing grew from 269,000 tons to over 3,000,000 tons. This phenomenal rate of growth—over two and one-half times faster than that of the pipe and tube making industry as a whole—to a large extent resulted from a series of important improvements in tube mill design, all introduced by Yoder.

First came the Yoder rotating welding transformer, in 1938. The economic and other benefits conferred by this epoch making innovation were further augmented by other technological advances scored by Yoder in the years that followed. The result was that electric-weld pipe and tube making became the child prodigy of the fast growing pipe and tube making industry.

Latest, and perhaps the greatest, of these developments is the cold forming and induction welding at high speeds of *aluminum, magnesium, brass, nickel, monel, and other non-ferrous metals and alloys.* This process is especially economical for making light and medium gauge tubes in sizes up to 8 in. dia. More and more leading non-ferrous metal producers and fabricators are installing these mills.

More complete information about this and other interesting Yoder developments in pipe and tube mill equipment may be had merely by asking for any of the following publications:

- ☐ Resistance-Weld Mills for making Steel Tubing up to 4" diameter.
- ☐ Induction-Weld Mills for making Non-ferrous Tubing.
- ☐ Resistance-Weld Mills for Steel Pipe up to 24" diameter.

THE YODER COMPANY

5504 Walworth Avenue **Cleveland 2, Ohio**

ENGINEERING YODER MANUFACTURING

PIPE AND TUBE MILLS—Electric Weld

ROTARY SLITTING LINES

COLD ROLL FORMING MACHINES

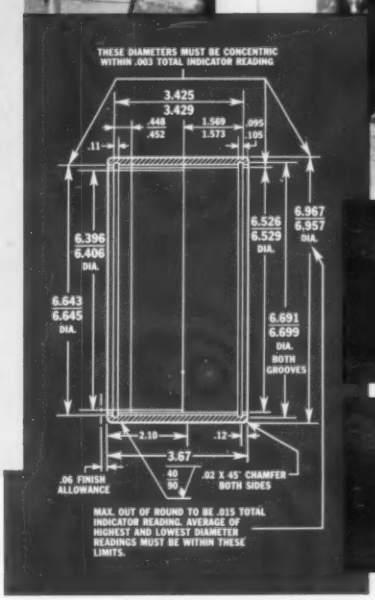
For more information fill in page number on Inquiry Card, on page 229

Automobile Manufacturer produces

Repetitive Pieces to Close Tolerances with

BULLARD MULT-AU-MATIC Type "L"

At one of the nation's largest automotive plants, a number of Bullard Mult-Au-Matics, Type "L" are employed to produce automatic transmission parts. According to the Process Engineer "The transmission is the most precision piece of equipment in the entire car — with many moving parts fabricated to close tolerances."



If you have need to manufacture to exacting tolerances it will pay you to investigate the many advantages offered by Bullard Mult-Au-Matic, Type "L".

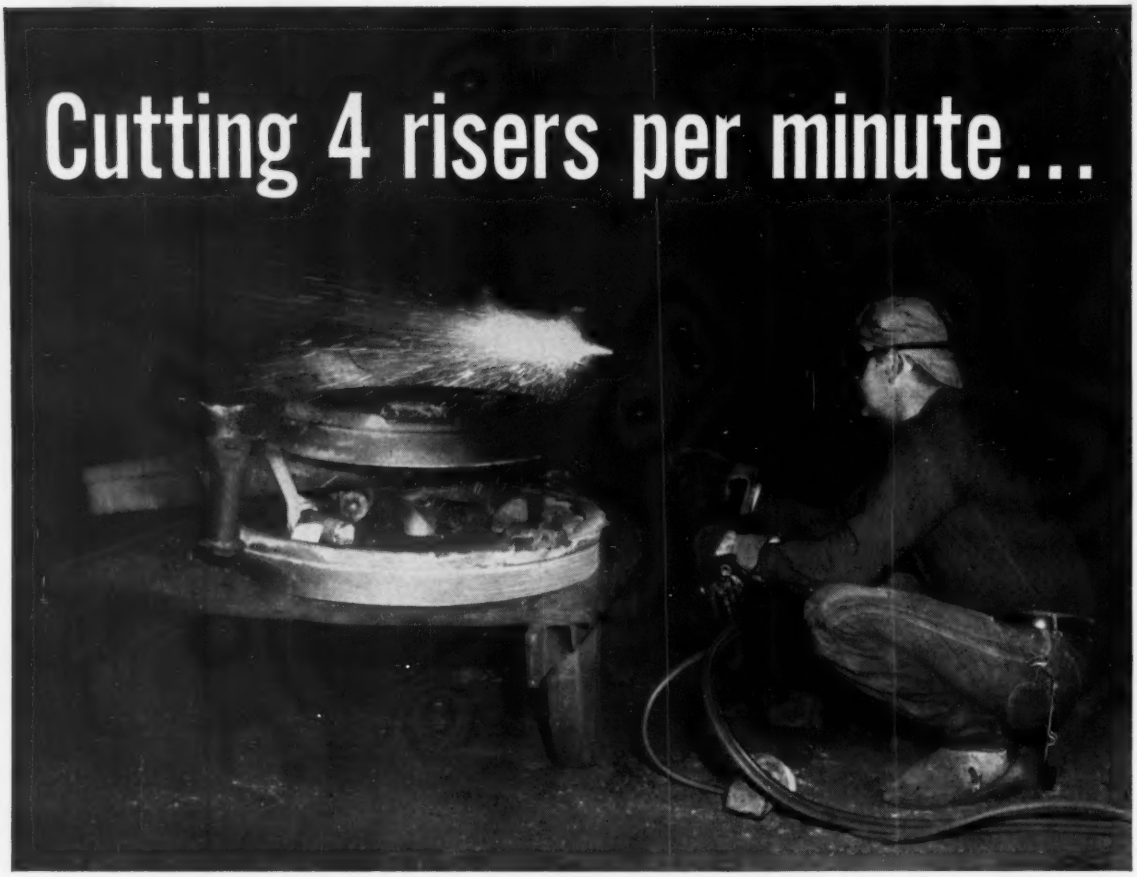
Send for catalog today

THE
BULLARD
COMPANY
BRIDGEPORT 9, CONNECTICUT

THE BULLARD COMPANY
286 CANFIELD AVENUE — BRIDGEPORT 9, CONNECTICUT
Please send me a copy of the
NEW MULT-AU-MATIC, TYPE "L" CATALOG

NAME _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

Cutting 4 risers per minute...



Lightweight and easy to handle, this OXWELD powder-cutting blowpipe makes fast work of risers.

Powder-Cutting speeds removal operations 300%

Removing risers from stainless steel castings need no longer be costly and time consuming. Pictured above is a typical powder-cutting operation at the Ohio Steel Foundry Company, Springfield, Ohio. Here, 2 by 4 inch thick stainless steel risers are removed by powder-cutting in only 15 seconds. By methods previously used, this operation took up to four times longer.

In the powder-cutting process metal powder is automatically injected into an oxygen flame to increase the flame's heat and severing action speed. The powder process is helping users gain new efficiency and speed in the removal of gates and risers, sand incrustations, and casting defects.

The powder-cutting blowpipe used in this operation, an OXWELD AC-4, is designed for hand cutting of oxidation resistant metals such as stainless steel, chrome alloys, and cast iron. Heavier apparatus is also available for manual and mechanized operations.

Increase your production and profit—call your local LINDE representative, or write for illustrated literature on LINDE's modern processes. Start saving now, do it today.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
In Canada: LINDE AIR PRODUCTS COMPANY
Division of Union Carbide Canada Limited, Toronto

Linde Trade-Mark

"Linde" and "Oxweld" are registered trade-marks of Union Carbide and Carbon Corporation.

16 surfaces

...on this Garrison Gear Chuck

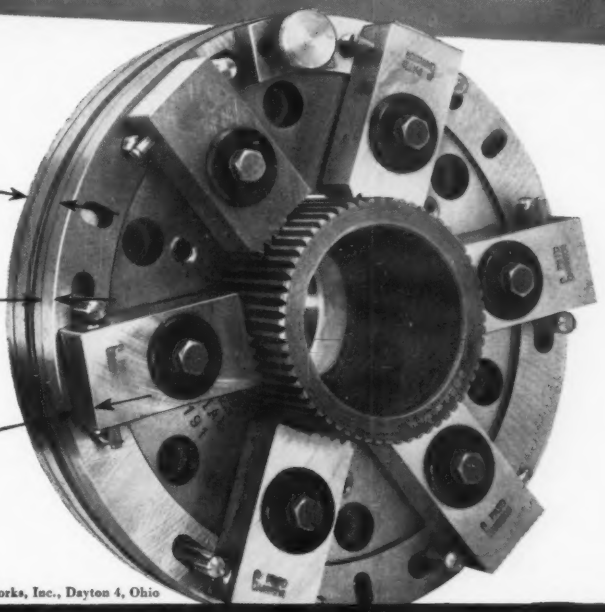


Photo courtesy of Garrison Machine Works, Inc., Dayton 4, Ohio

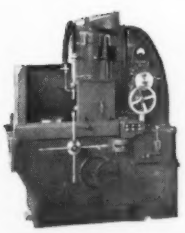
are Blanchard ground for precision

As every machinist knows, machine tools impart their precision through their chucks. That's why chuck dimensions and tolerances are of critical importance . . . and why Blanchard Surface Grinders are commonly used to produce the flat surfaces required.

Blanchard Surface Grinders are ideal for all kinds of precision grinding jobs. They produce extremely close tolerances for flatness, size and parallelism . . . *at low costs and high production rates.* Many Blanchard users grind surfaces flat to within 2 to 4 light bands, parallel to less than .0001", with dimension tolerance of .0002", and surface finish to better than 3 micro inches.

Whether your work involves precision machining or rapid removal of stock, take the advice of master machinists . . .

PUT IT ON THE BLANCHARD



No. 11 Blanchard Surface Grinder

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

For more information fill in page number on Inquiry Card, on page 229

GENERAL ELECTRIC ANNOUNCES . . .

NEW Industrial

Direct-current Motor

KINAMATIC* a new standard in direct-current motors, gives your machines wider speed ranges, greater output

To meet modern industrial needs for faster, more automatic, more continuous production, General Electric has designed an entirely new direct-current motor—the d-c Kinamatic.

Designed for Automation—Now, a direct-current motor has been designed for the modern job it has to do—either as individual motor drive or in regulating systems. The new General Electric d-c Kinamatic motor supplies the wide speed range and versatility required for today's manufacturing methods. It is designed for the close control of machines and split-second timing of processes essential to higher output.

Accelerated Production—The new d-c Kinamatic motor will modernize your equipment, give it increased power, higher speeds, greater output capacity. With the quick-acting G-E Kinamatic motor, your machines will process a greater variety of products . . . faster . . . easier . . . and with less maintenance and spoilage.

More Powerful—By combining advanced design with improved materials and manufacturing techniques, General Electric engineers have packed more power into the entire Kinamatic line. The powerful Kinamatic motor, with new stamina and durability, is ready to become one of your most effective weapons for keeping costs down, for meeting competition, for boosting productivity levels.

Engineering Help—Industrial specialists in 149 conveniently located General Electric Apparatus Sales Offices have the complete story on how the new d-c Kinamatic motors and generators can benefit your operation. For full details, contact your G-E Sales Representative, or write for Bulletin GEA-6355. *Direct Current Motor and Generator Department, General Electric Company, Erie, Pennsylvania.* 813-1

* Trade Mark of the General Electric Company

Progress Is Our Most Important Product

GENERAL ELECTRIC

WHATEVER you need in mechanical gages

Consult STANDARD® First

IT'S a great advantage to work with a firm that presents a complete line . . . to deal with gage makers who understand your problems . . . to get the one gage *just right* for *your* job. Whether you work from our catalog or consult with us, you are assured the finest available instruments for your particular needs.

GAGES are our only product. To you, that means the benefit of over 30 years concentrated knowledge and experience. It also means wide selection, progressive design and time-and-money-saving innovations. For instance: Dializer® for converting ordinary snap gages to dial snap gages; DuBo® plug gage which tells more, more easily; Versa Dial® basic dial unit for a host of applications. These are some of the reasons *it pays* to *standardize* on STANDARD. Your inquiries are invited.

Send for Catalog

STANDARD GAGE COMPANY, INC.

MEASURING INSTRUMENTS FOR PRECISION INDUSTRY

112 PARKER AVE. POUGHKEEPSIE, N. Y.

STANDARD® Gages

For more information fill in page number on Inquiry Card, on page 229

"Only by systematic planning and budgeting for equipment replacement can

ASSOCIATED SPRING CORPORATION

maintain its position in the trade and insure our services in the years to come."

Ernest L. Goff
Executive Vice President
Associated Spring Corporation
Bristol, Connecticut

"The Associated Spring Corporation, manufacturers of precision mechanical springs and specialty spring steels systematically replaces its machinery and equipment. Our Corporation has twelve manufacturing divisions located in the principal metal-working centers in the U. S. and one in Canada. All plants use similar types of equipment and therefore compete for the necessary funds to maintain flexibility of production, improved quality and lower costs.

"The mechanical spring production is made only to customers' specifications and therefore somewhat different from the production of standard parts or consumer products. This obviously presents management with the perplexing problem of providing the necessary equipment on short notice.

"In 1954 management established a five-year equipment replacement and modernization program. Closely following the MAPI formula, each division's Industrial Engineering Department is charged with the responsibility of making annual surveys and reports to management. A complete record is maintained showing stage of obsolescence, maintenance cost and anticipated replacement date.

"In order to provide for orderly financing of our five-year program, a long-term capital equipment budget has been prepared showing the funds that will be needed and how acquired. Needless to say, these funds will not come entirely from normal depreciation.

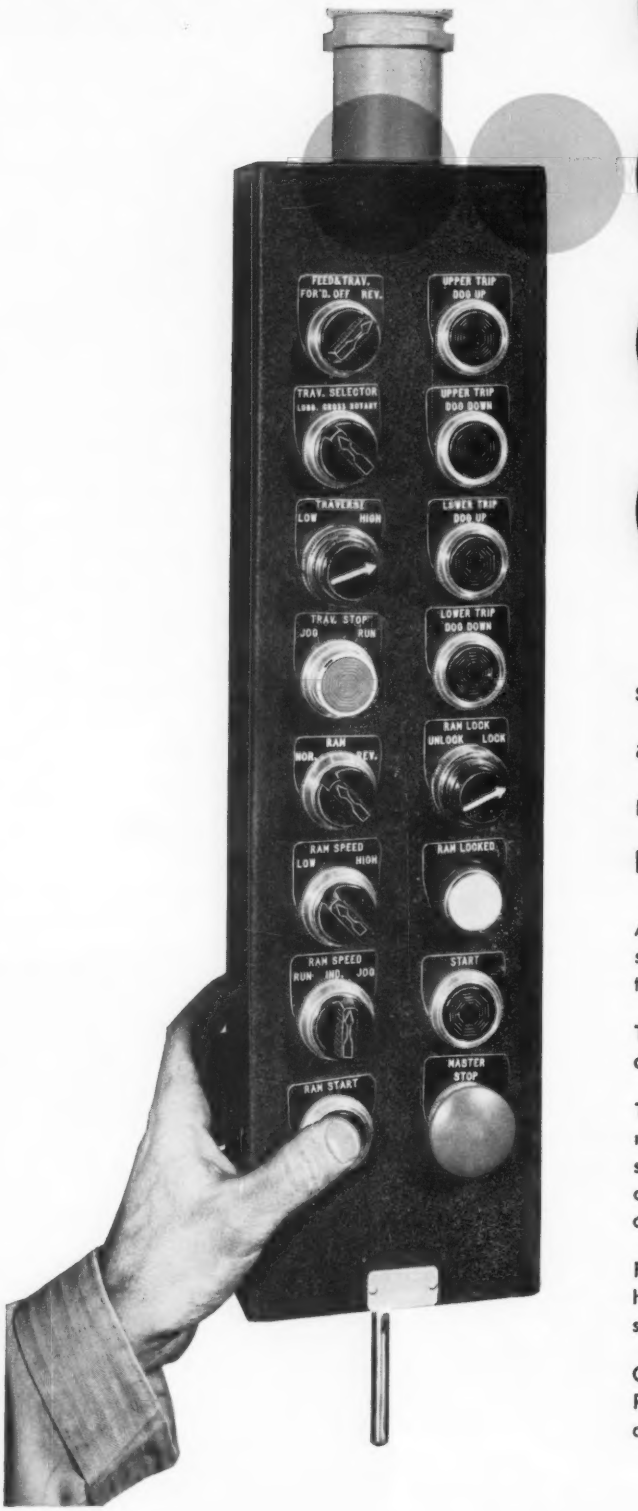
"In our present economy, we are not unmindful of the additional problem of further developments in mechanization if not automation.

"Only by the systematic planning and budgeting for equipment replacement can Associated Spring Corporation maintain its position in the trade and insure our services in the years to come."

Keep gathering metal-working production ideas . . . be well informed when you replace machinery

ROCKFORD *Insert* GROUP

June, 1956



push button control

speeds operation and set-up on new Rockford **hydraulic** slotter

All longitudinal, transverse and rotary movements are selected and operated from the push button station of this new Rockford hydraulic Slotter.

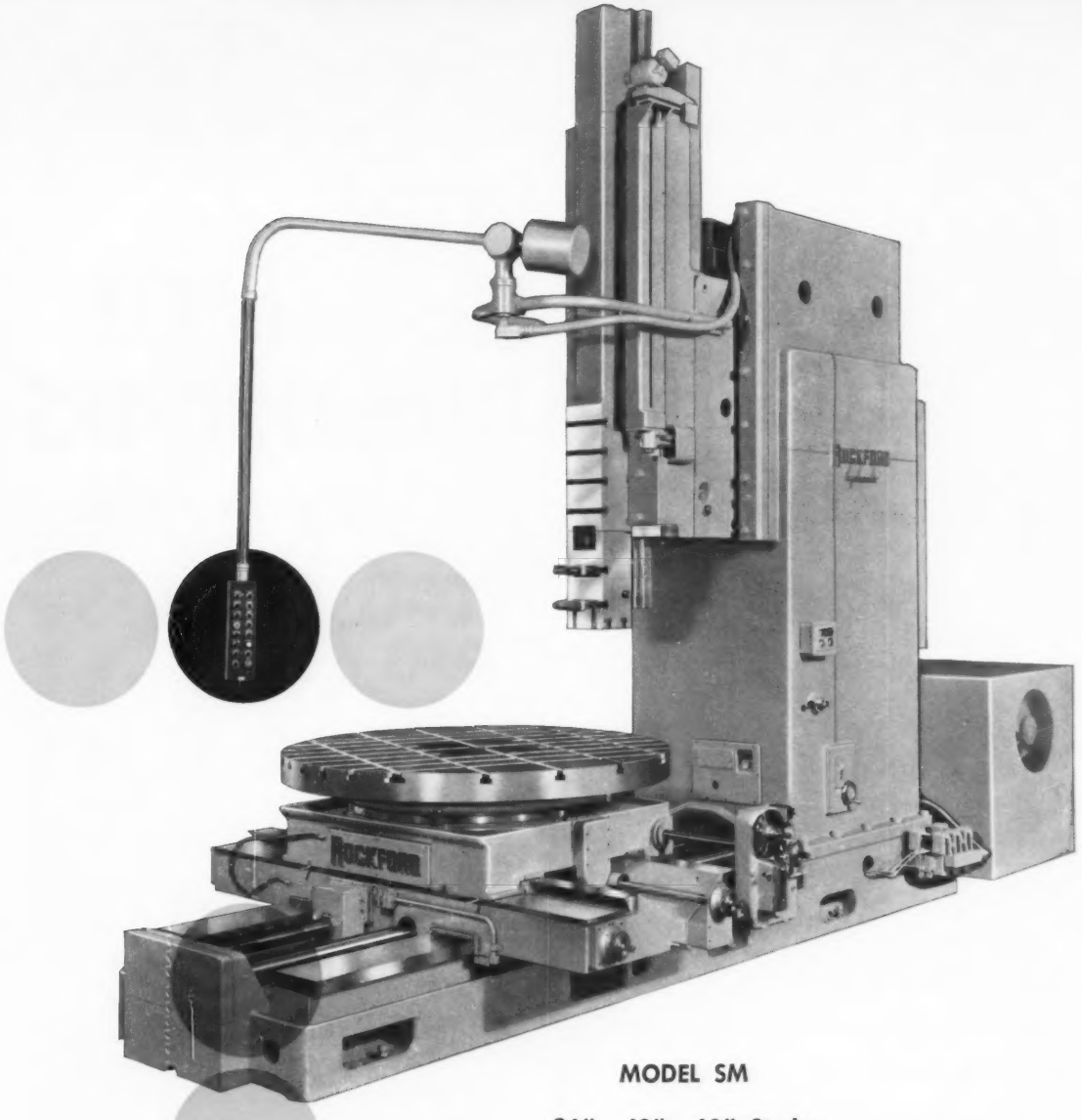
The ram lock is pendant operated and ram stroke length and position are completely push button controlled.

Two-speed table traverse is available, enabling the machine operator to position the work to a few thousandths, without manual movements, although manual control of all movements is available from either side of the machine.

Full hydraulic drive provides two cutting ranges, one for high speeds and low cutting forces; the other for slow speeds and heavy cuts.

Get full details on this new hydraulic slotter from any Rockford Machine Tool Co. representative, or write directly to us.

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



MODEL SM

36" 48" 60" Stroke

Counterbalanced pendant control covers 240° range.

Hydraulic Feeds and speeds, infinitely variable.

Built-in Dividing head with Power Indexing.

Predetermining counter saves labor in rotary positioning.

ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

HYDRAULIC

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

PRODUCTION MACHINERY

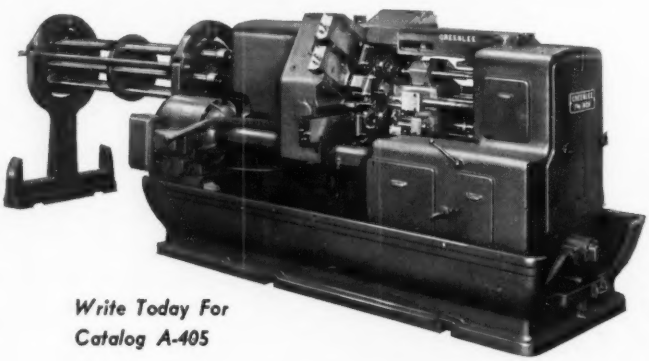
GREENLEE

INTER-CHANGEABLE TOOL HOLDERS

FIT ALL CROSS-SLIDES ON GREENLEE BAR AUTOMATICS

They Save You Set-Up Time . . . Reduce Tooling Costs

Tool holders can be quickly and easily changed from one position to another . . . from one Greenlee machine to another (within their size range). All cross-slide cavities are identical . . . tool holders fit these cavities exactly. Greenlee Interchangeable Tooling is more *flexible* . . . more *efficient* . . . more *economical.* On short runs especially, the savings on setup time is considerable. Greenlee engineers will be glad to show you how to attain maximum production with a minimum number of tools and holders. Take advantage of this valuable service now.



Write Today For Catalog A-405

4-SPINDLE 6-SPINDLE
SECOND OPERATION
PNEUMATIC STOCK FEED

Do you receive a copy of the Greenlee "Automatic News" regularly? If not, write and ask to be placed on our mailing list. Give company name and job responsibility.

PRODUCTION MACHINERY

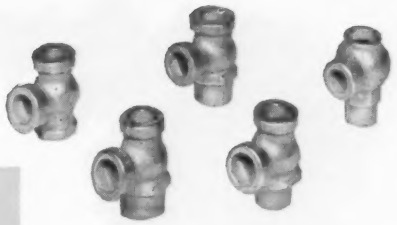
GREENLEE

GREENLEE BROS. & CO.
1868 Mason Avenue
Rockford, Illinois

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

REHNBERG-JACOBSON

5 DIFFERENT VALVE BODIES



1 MACHINE

DRILLING

HOLLOW MILLING

REAMING

TAPPING

THREADING

MACHINE INCLUDES MANY PRACTICAL QUICK-CHANGE FEATURES

By the use of interchangeable jaws on the hydraulic-clamping fixtures, and by the use of some rotatable heads — this single machine is arranged to handle *five different types* of brass valve bodies. The machine finishes each valve body complete except for the seat operations; it does hollow milling, drilling, and reaming on the ends, then taps or threads where required. Since some of the valve outlets are tilted instead of straight, two of the side units are arranged with rotatable angular mounts inside of angular housings—to present the spindles either straight or angularly as needed. Two of the vertical tapping units are mounted on rotatable flanges and equipped with different lead screws, so the change from one pitch to another can be accomplished rapidly. In addition to these and other features which reduce down-time, the machine has a capacity of *400 to 500 valve bodies per hour* — all-in-all a very efficient and versatile piece of production equipment! *Be sure to consult Rehnberg-Jacobson whenever you have a production problem.*

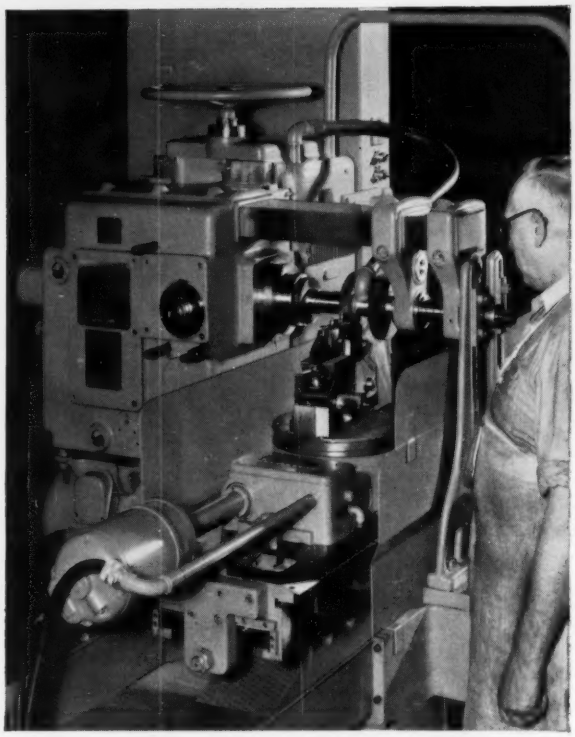
REHNBERG-JACOBSON
MANUFACTURING CO.
ROCKFORD, ILLINOIS

REHNBERG R-J JACOBSON

DESIGNERS, ENGINEERS
MANUFACTURERS AND
PRODUCTION CONSULTANTS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

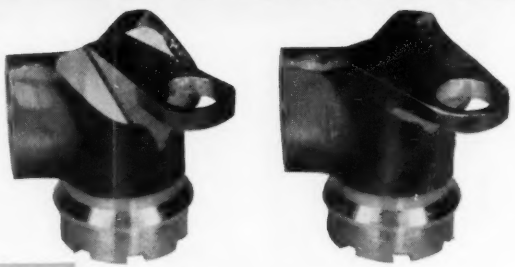
For Better Milling Methods and Lower Costs..



Use SUNDSTRAND Machines and "Engineered Production" Service

Basically, there are two approaches to solving milling problems, (1) obtaining standard machines, then trying to process parts over these machines as economically as possible, (2) designing the most profitable processing method, then obtaining machines to suit this method — standard or semi-standard machines, if possible, or entirely special machines, if necessary. This latter method is Sundstrand "Engineered Production" . . . the most practical approach to economical milling.

The following three examples of Sundstrand "Engineered Production" Service show how (1) a standard Rigidmil (2) a semi-standard Rigidmil and (3) a special Rigidmil are used to solve three different production milling problems. Even though your problem may not be shown, the experience Sundstrand engineers have gained in solving these and many other problems enables them to offer the most practical solution for your specific job. Just ask for a Sundstrand "Engineered Production" analysis of your milling job.



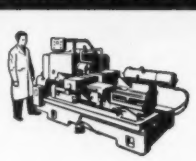
1

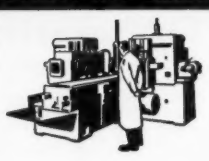
Standard Rigidmil Mills Fuel Nozzles

This standard Model 22 Rigidmil has been provided with a standard automatic index base for milling the bosses on body fuel nozzles. Its two fixtures permit the operator to unload and re-load parts during the milling cycle on another part to make loading time free.

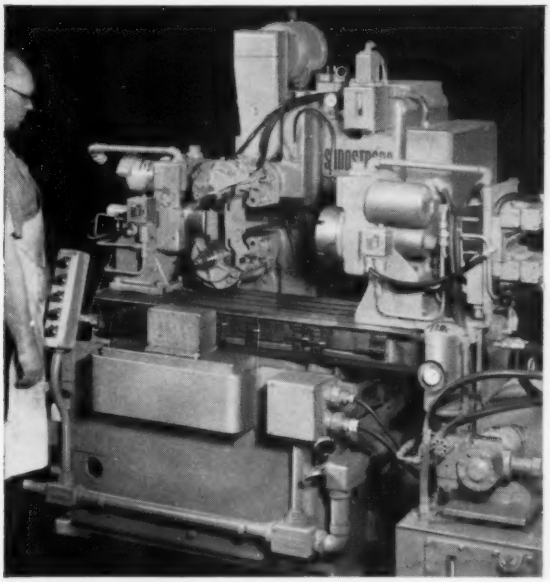
SUNDSTRAND "Engineered Production" Service* *REG. U.S. PAT. OFF.

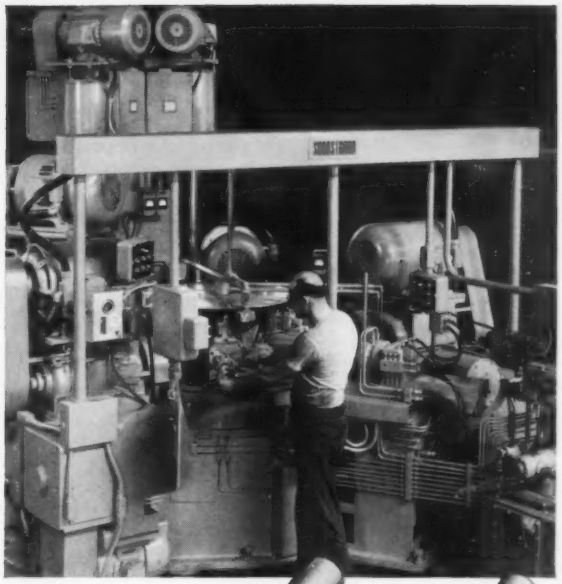
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

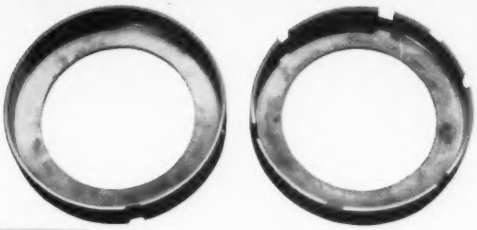




CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**





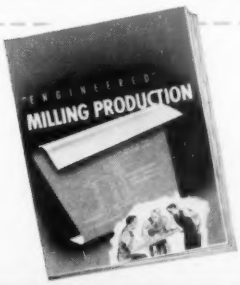


2 Milling Clutch Drums On Semi-Standard Rigidmil

This standard Sundstrand Model 22 Rigidmil is provided with two spindle heads and two automatic index bases for milling six slots in a transmission neutral clutch drum.

3 Milling Output Shafts On Special Rigidmil

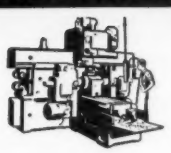
This special Sundstrand 6 station indexing machine has a 48″ diameter automatic indexing table. It mills 3 pockets in each flange of an automotive transmission output shaft.

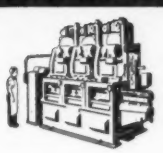


FREE DATA

You'll find plenty of milling methods in this book . . . methods that may provide a short cut or profitable solution to similar jobs in your shop now. Tooling diagrams and machine designs are both included. Write for your copy today. Ask for Bulletin No. 668.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

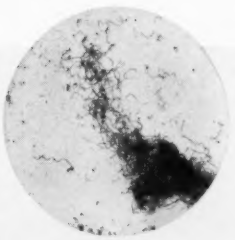
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

"Power Designed" for Profitable Production,

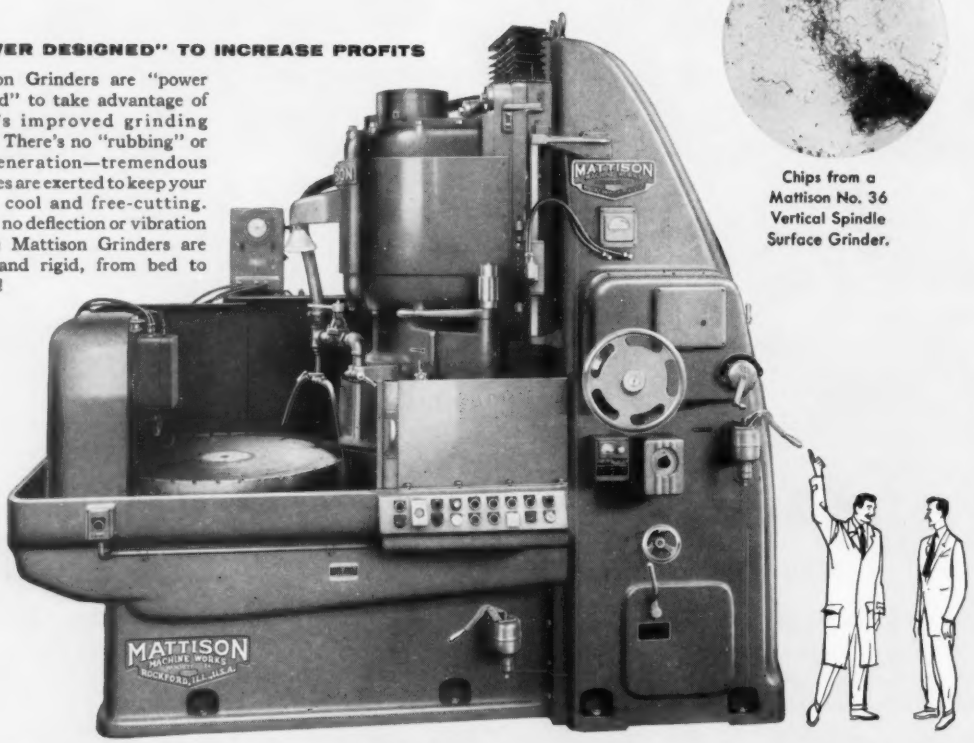
MATTISON VERTICAL SURFACE GRINDERS ARE NOW BETTER THAN EVER!

"POWER DESIGNED" TO INCREASE PROFITS

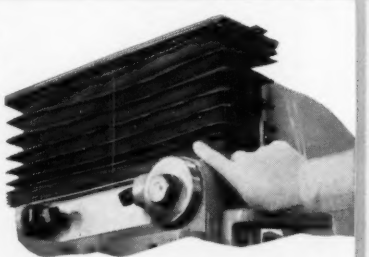
Mattison Grinders are "power designed" to take advantage of today's improved grinding wheels. There's no "rubbing" or heat generation—tremendous pressures are exerted to keep your wheels cool and free-cutting. There's no deflection or vibration because Mattison Grinders are heavy and rigid, from bed to spindle!



Chips from a Mattison No. 36 Vertical Spindle Surface Grinder.



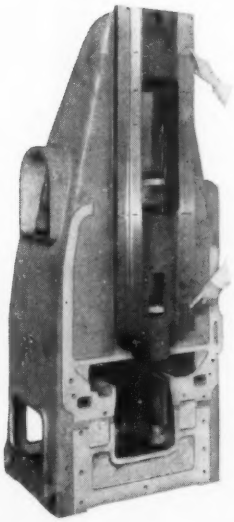
NEW, STRONGER BASE—It's stronger and more rigid . . . with cross-rib and flange construction from finest quality Meehanite metal . . . stress relieved by heat treating. It's not a coolant container. Changes in coolant temperature cannot affect accuracy. Large "V" and flat ways give you more weight-bearing surface for heavy grinding. Table carriage stays in accurate alignment.



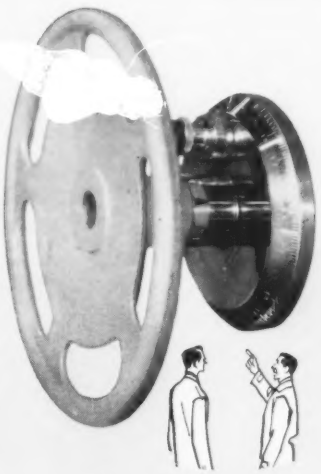
NEW COLUMN WAY GUARDS—Bellows-type guard protects upper "V" and flat ways of column. New telescoping steel guard protects lower ways. Ways of bed are never exposed, whether carriage is *in or out*. Wear and maintenance are reduced, accuracy lasts longer.

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

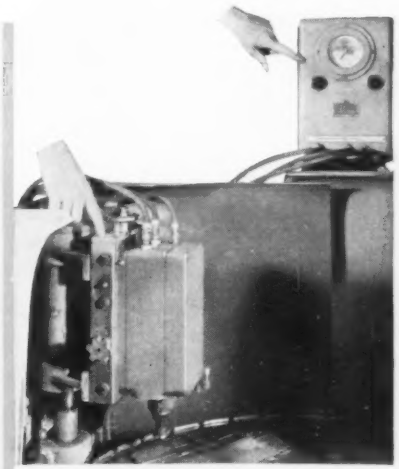
Yes... Mattison Vertical Surface Grinders are a better investment today, with extra horsepower and *new* design features to speed your jobs and control your costs! Now you can increase accuracy with Mattison's automatic, continuous feed . . . boost your production with automatic cycling and work sizing . . . increase stock removal with Mattison's heavier, more rigid construction. Measure . . . compare features . . . prove to yourself how these improved grinders reduce machining costs. Ask your Mattison dealer for the complete story.



LARGER, HEAVIER COLUMN—It's bolted and keyed to the base, giving you rigidity equal to one-piece construction. Column is wider and deeper at base height . . . provides extra rigidity for heavier stock removal, finer finish, and greater accuracy. Longer and wider "V" and flat ways provide the rigid support necessary for more powerful spindle motors and accurate feed control.



NEW CONTINUOUS DOWN FEED—With Mattison's new continuous feed, you can *split* the last increment of a ratchet-type feed and increase accuracy. And, there's no limit to the feed rate because of linkage actuation. New, wider feed ranges are profit-boosters on many jobs. Horsepower and wheel capacity are your only limiting factors. It's easy to grind accurate parts!



AUTOMATIC GAUGING SYSTEMS—Mattison offers a choice of automatic sizing systems to increase your production and control quality. Air gauging system continuously measures the work and gives operator visual indication that parts are approaching size. Micro-switch automatic sizer is an electro-mechanical device which continuously measures the work and actuates the automatic cycle at the completion of the grind, after which the machine is ready for the next load.

LARGE CENTER PLATE IN CHUCK—It's easy to service the collector ring and brushholder assembly of a Mattison magnetic chuck through the large 7½ in. center hole. Saves many hours of downtime.

MATTISON MACHINE WORKS

Rockford, Illinois

If it's a flat surface, there's a Mattison to grind it!

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

Something more

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

than pushbuttons...

starts the machine-built accuracies in a *Hendey* Tool and Gage-Makers' Lathe

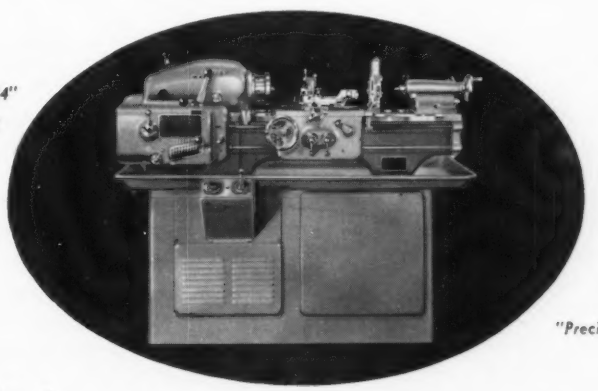
Precision *begins* with precision!

At the left a Hendey worker checks headstock spindle bore alignment of a 9 in. Tool and Gage-Makers' Lathe. *But,* before he pushes the "Start" button of his machine, he uses most exacting precision to lay out holes to be bored in the headstock. He begins by carefully locating the spindle bore, using "Jo" blocks (capable of measuring in millionths) to assure maximum accuracy. After finding this starting point, he locates other holes in precise relationship to it. Precision machining and finishing are the inevitable result of meticulous preparation and layout.

The 9 in. Tool and Gage-Makers' Lathe can be purchased with *electronically controlled* drive to provide quiet, infinitely variable spindle speeds from 15 to 3000 rpm. On facing cuts, stepped diameters, and tapers, operator can change speeds during the cut by selecting correct rpm on the control rheostat. Belt drive gives smooth, vibration-free power to the spindle for extra-fine finishes in the range from 25 to 3000 rpm. Speed range from 15 to 250 rpm is through back gears with very low velocity.

Remember, in your toolroom too — precision *begins* with precision! You can assure accuracy and reduce turning costs by installing a Hendey Tool and Gage-Makers' Lathe. Call your Hendey dealer now for complete information.

Hendey 9" x 24" Tool and Gage-Makers' Lathe



"Precision with Production"

Hendey **machine division**
BARBER-COLMAN COMPANY
62 LOOMIS ST., ROCKFORD, ILLINOIS

BARBER COLMAN ®

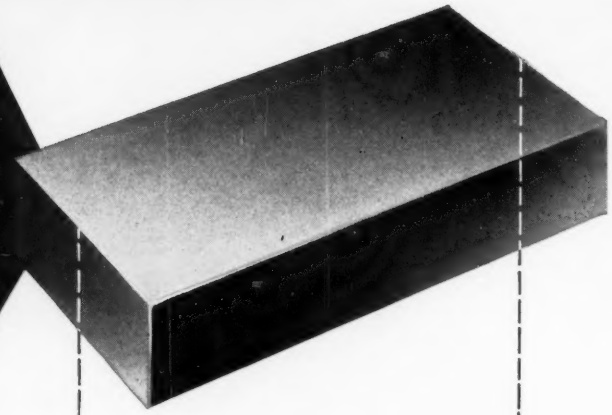
FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.

ROCKER ARM

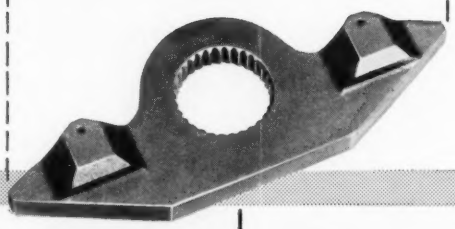
machined from bar stock

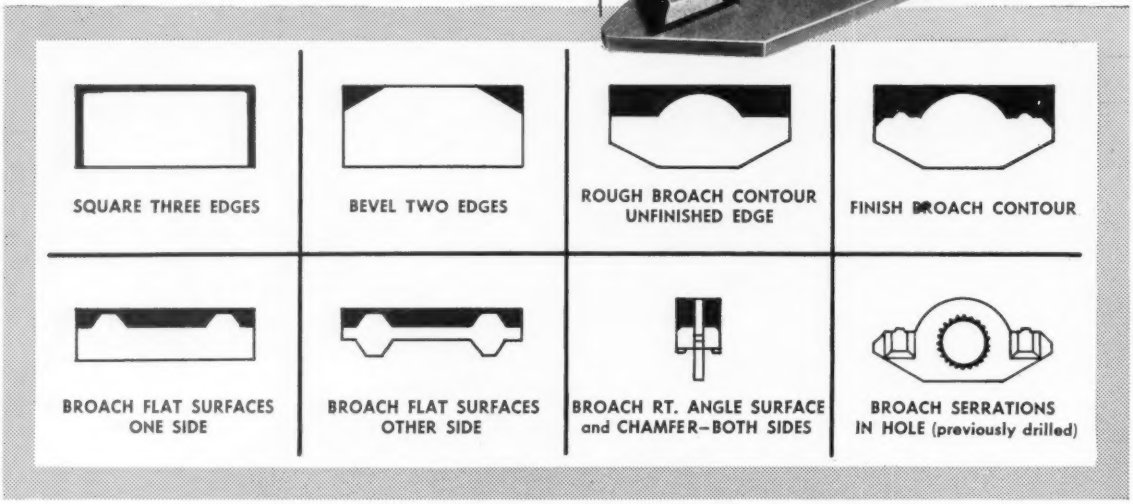
in 8

BROACHING OPERATIONS



Broaching's all-round versatility is illustrated by this unusual adaptation of a standard American 3-Way broaching machine for the production of finished rocker arm part from bar stock. The eight broaching operations are shown in sequence below.




SQUARE THREE EDGES
BEVEL TWO EDGES
ROUGH BROACH CONTOUR UNFINISHED EDGE
FINISH BROACH CONTOUR
BROACH FLAT SURFACES ONE SIDE
BROACH FLAT SURFACES OTHER SIDE
BROACH RT. ANGLE SURFACE and CHAMFER–BOTH SIDES
BROACH SERRATIONS IN HOLE (previously drilled)

Small quantity production of this rocker arm part, plus a requirement that all surfaces be finished, made a forging impractical. Broaching gave the desired finish and confined the operations to one machine so that holding and locating fixtures were simplified.

American designed and built the broaches and had previously supplied the 3-Way vertical hydraulic broaching machine. But to American's good customer, The American Tool Co., Kalamazoo, Mich., goes the credit for the ingenuity displayed in developing the operation and building the interchangeable fixtures.

Whether you require eight operations on few parts, or one operation on thousands, the versatility of American broaches, fixtures and broaching machines can mean gains in your output, cuts in your costs. Give American the details; you'll receive a prompt recommendation.

ASK FOR CATALOG 450

AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

SUNDSTRAND

American Building - Ann Arbor, Michigan

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

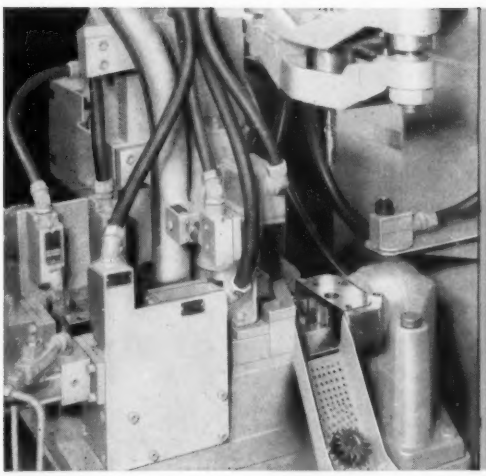
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

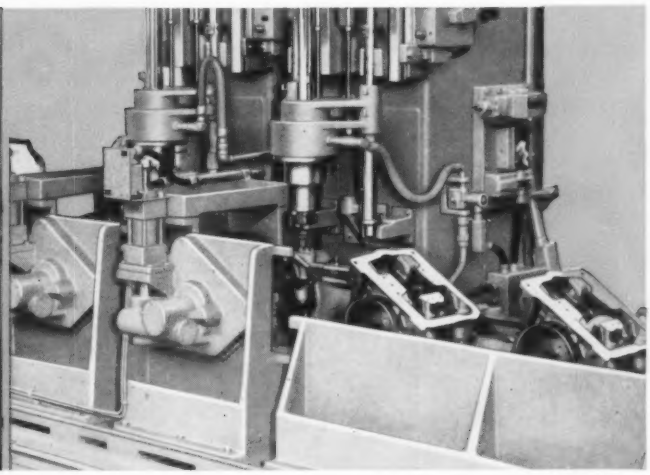
automated honing

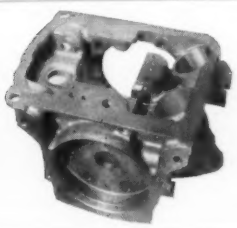
for connecting rods, gear bores, or other parts requiring high speed automatic production

Full Automation

Loading
Clamping
Honing
Sizing
Unclamping
Unloading
Gaging and Selecting







BarnesdriL Honing Machines for specific production applications are arranged with fully automatic loading and processing cycle. Parts with oversize bores unsuited for honing are automatically rejected, and selected parts advanced to the honing position. Parts are honed and sized to preselected tolerances, and finish, and then discharged automatically.

All steps in the cycle are under cycle-control. Stock is removed, surface selectively finished, precision bore-to-bore sizing guaranteed, all within the automatic cycle. BarnesdriL exclusive control over abrasive wear eliminates size differences bore-to-bore. Honing stone design provides cutting support right up to the cutting edge, for longer life and free cutting action.

Consult a BarnesdriL engineer for application of automatic controlled sizing and finishing for your high production parts.

DETROIT OFFICE — 3419 South Telegraph Road, Dearborn, Michigan

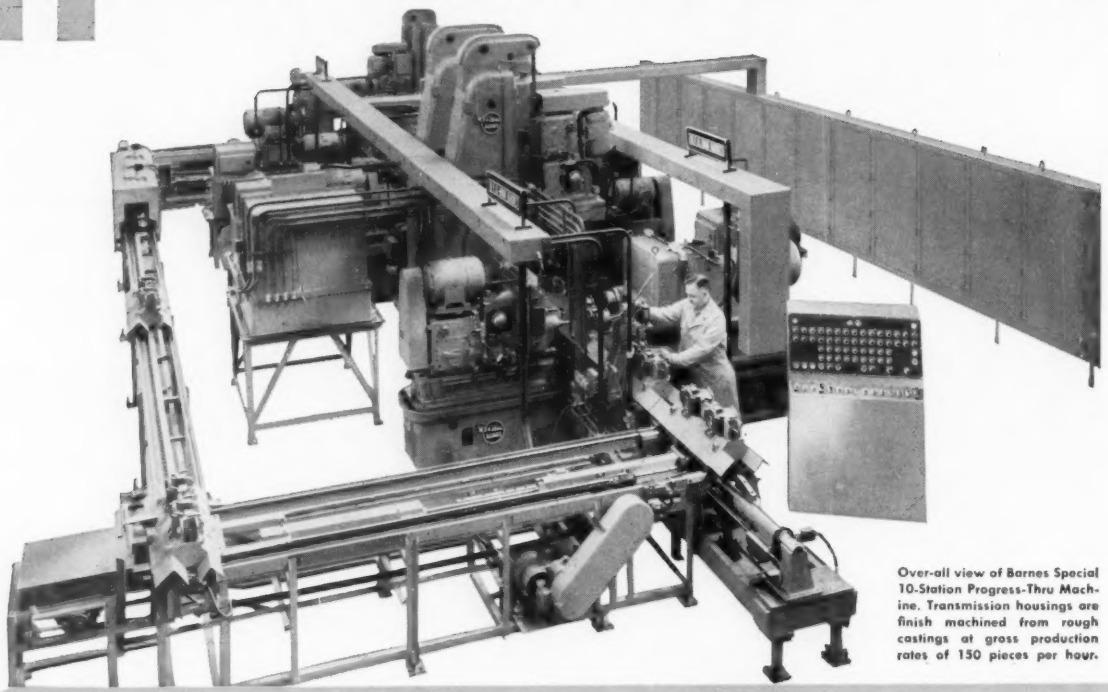
BARNES DRILL CO.

820 CHESTNUT STREET ● ROCKFORD, ILLINOIS

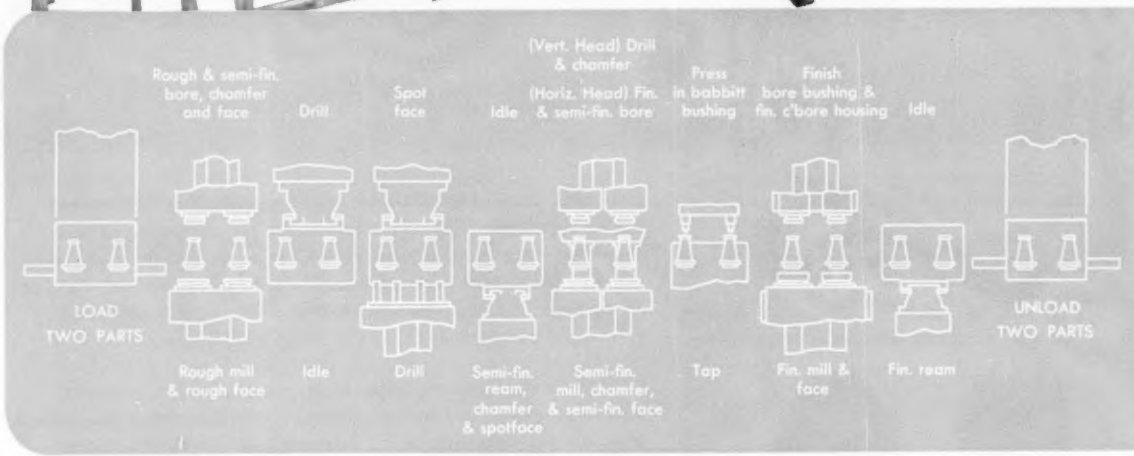
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

TRANSMISSION EXTENSION

HOUSINGS NOW MACHINED COMPLETE



Over-all view of Barnes Special 10-Station Progress-Thru Machine. Transmission housings are finish machined from rough castings at gross production rates of 150 pieces per hour.



▲ Schematic drawing of machining operations. Total concentricity on all operations does not exceed .002". Housings are held in transfer plates which are located by two hydraulically actuated dowels and clamped hydraulically at each machining station.

Builders of Better Machines Since 1872

W. F. & JOHN BARNES

Special Machine Tools

Special Conveyor Units

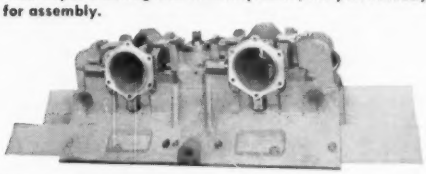
Special Process Equipment

MULTIPLE SPINDLE DRILLING • BORING • TAPPING MACHINES

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

FROM ROUGH CASTING TO FINISHED PART

Transmission extension housings are finish machined in automatic cycle from rough casting to finished workpiece. After rapid washing and final inspection, the part is ready for assembly.



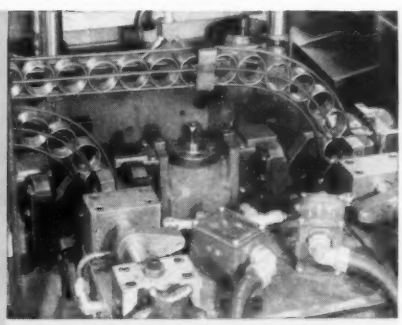
View of workpieces in special transfer plate fixture. Both housings are located and accurately positioned by means of dowels and screw-operated V-block clamps.

ON

W. F. & JOHN BARNES SPECIAL 10-STATION PROGRESS-THRU MACHINE

Here is another typical example of how W. F. & John Barnes Six-Point Machine Tool Building Service has helped increase production efficiency for a leading automobile manufacturer. All machining operations on transmission extension housings are now combined in one Special Barnes 10-Station Progress-Thru Machine at a production rate of 150 pieces per hour. Two operators, one at the loading end and the second at the unloading end, load and unload housings on transfer plates which carry workpieces through the entire machining cycle. Operations include boring, facing, milling, drilling, reaming, automatic press-in of babbitt bushings, and combination finish bore babbitt bushing and finish counterbore housing.

Whether your production requires large or small machines, you'll find the coordinated services at Barnes can help you solve problems quickly and efficiently.



Closeup of station seven where babbitt bushings are automatically pressed-in to the small end of the housings. Bushings are hopper loaded by operator at the unloading station.

BARNES' COORDINATED 6-POINT MACHINE TOOL BUILDING SERVICE INCLUDES:

1. **SPECIALIZED MANUFACTURING FACILITIES**—75-year background, large well equipped plant efficiently tooled to build high production machines.
2. **SPECIAL HYDRAULIC EQUIPMENT**—designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.
3. **SPECIAL ELECTRICAL EQUIPMENT and CONTROLS** — individually designed and built for maximum safety and ease of control, with circuits that assure the most dependable coordination of all machine functions.
4. **SPECIAL GAUGES, FIXTURES, TOOLS**—designed for each individual machining problem, assure accuracy of operations at high production speeds.
5. **SPECIAL HANDLING AND CONVEYOR EQUIPMENT** — designed and built to reduce work handling, effect maximum safety and efficiency.
6. **COORDINATED DESIGN AND ENGINEERING**—Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

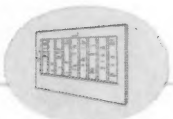
WRITE FOR FREE BOOKLET

Ask for free booklet "Coordinated Machine Engineering" describing the scope of Barnes machine tool building service.

W. F. & JOHN BARNES COMPANY

MACHINE TOOL DIVISION

402 SOUTH WATER STREET, ROCKFORD, ILLINOIS

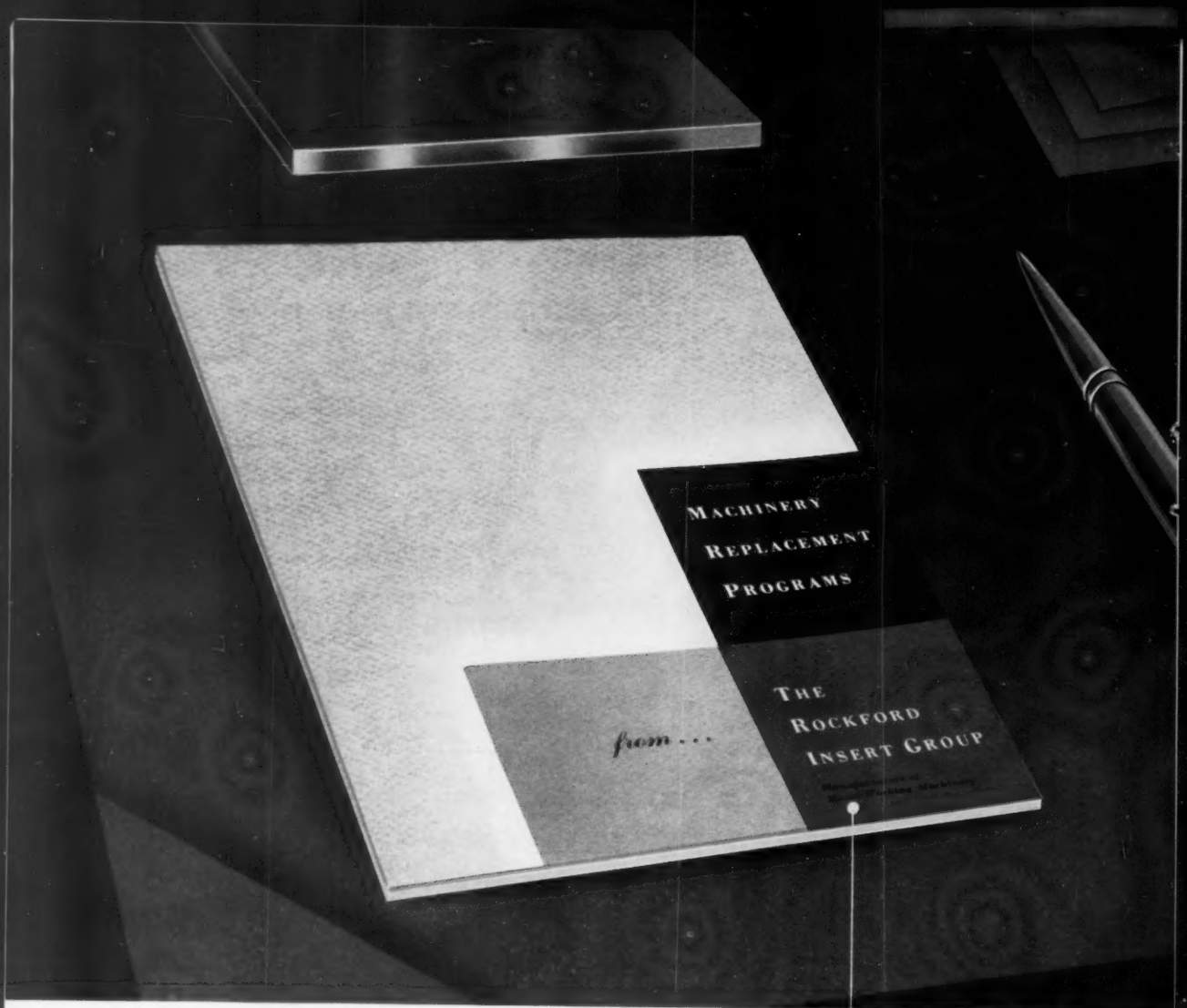


Special Electrical Controls

Food Machinery

AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

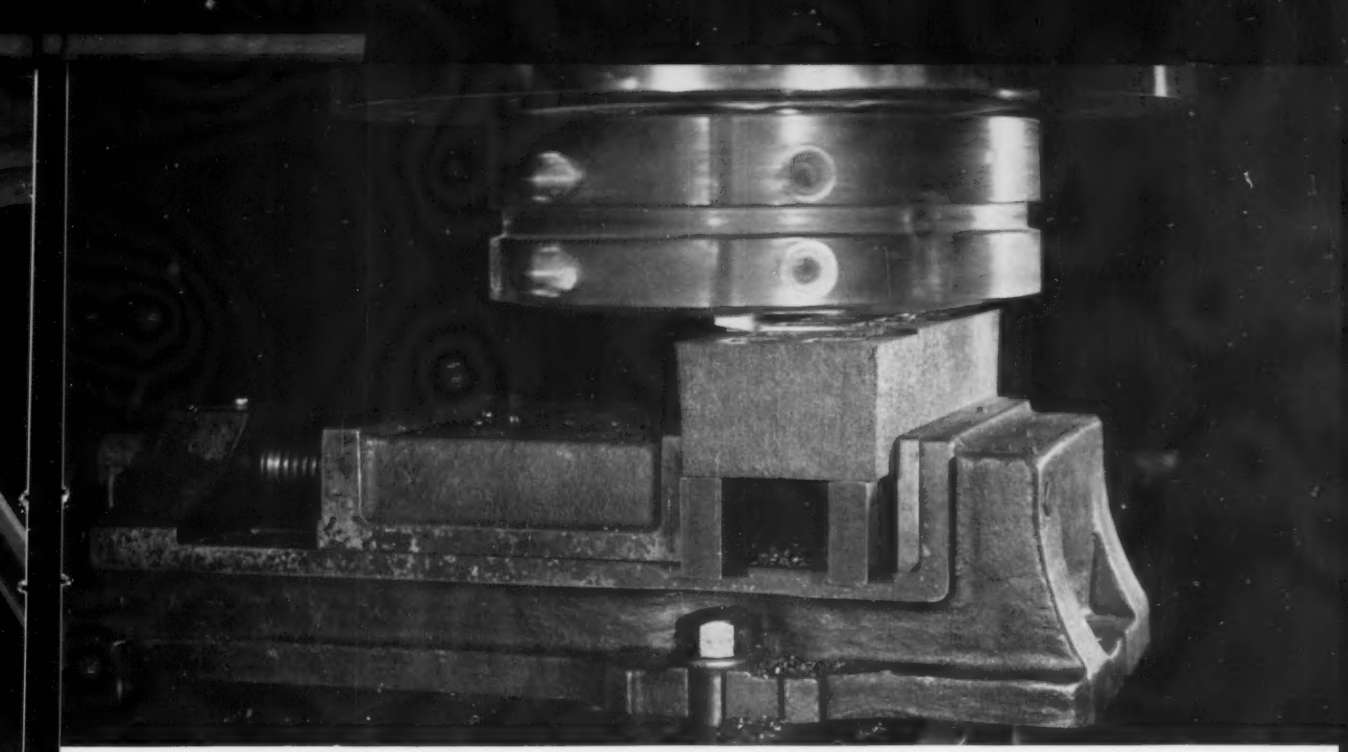


If you have a *Finger* in Machinery and Equipment buying you should have **this book**

Fifteen prominent industrialists discuss their machinery and replacement programs in this book. This valuable information represents the most up-to-date collection of evidence of the importance of such programs in industry today. For your free copy merely write to any one of the companies in the Rockford insert group.

Keep gathering metal working production ideas . . . be well informed when you replace machinery . . . . . .

Rockford Insert Group



Grade 860 – .012" wear, no chipping

Grade "A" – .035" wear, some chipping

Grade "B" – .025" chipped

Wear land comparison tests prove Grade 860 provides greater resistance to chipping, cratering. After milling 72¾ lineal inches on a cast-iron block with interrupted cuts to simulate cylinder blocks, wear on Grade 860 is minute. Two typical carbides tested under identical conditions show extensive chipping. **Speed** – 377 fpm. **Feed** – .0096". **Table travel** – 1¼ ipm. **Depth of cut** – .100".

On high-tensile gray cast irons . . .

TOUGH, NEW CARBOLOY MILLING GRADE 860 GREATLY REDUCES CHIPPING AND CRATERING

Carboloy® Milling Grade 860 was specially developed to provide longer tool life on the harder, denser types of gray cast iron now coming into common use.

Stronger cutting edges make Grade 860 far more resistant to chipping and cratering than any other available carbide. Tougher internal structure provides longer tool life and more production per grind.

Improves production 20-30%

Carboloy Grade 860 has been tested for almost a year on high-tensile cast irons ranging from 223 to 248 Brinell hardness. Despite scale and interruptions, this new carbide has consistently outperformed ordinary grades by 20-30%.

At speeds ranging from 250 to 300 fpm, Grade 860 produces excellent finishes. It is especially efficient for face milling operations, and can also be used to advantage for plain milling.

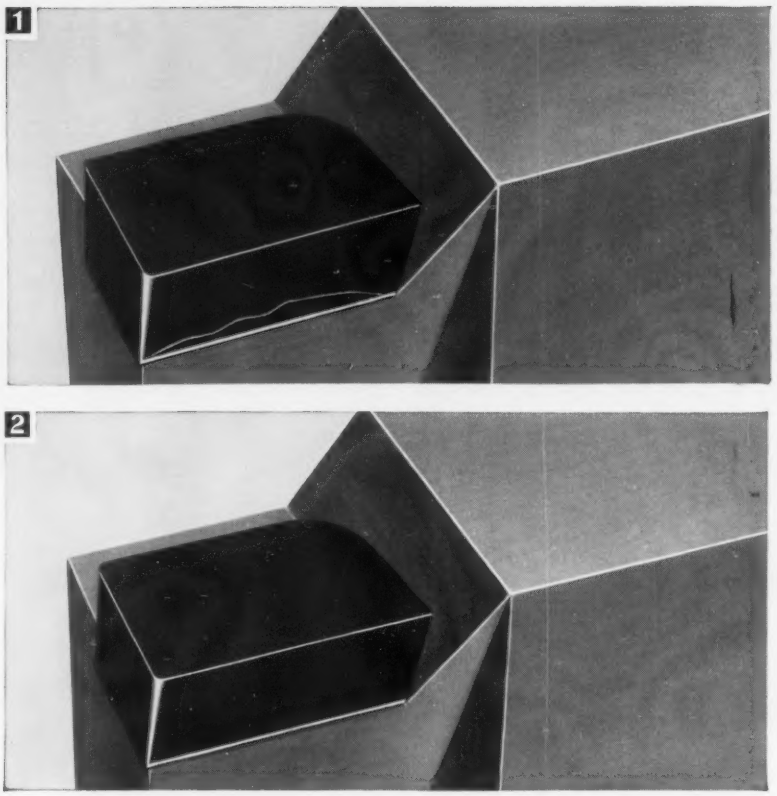
Specify new Carboloy Grade 860 for your milling cutters. For more details or technical information, write today . . . or mail the coupon on page 4 of this advertisement.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

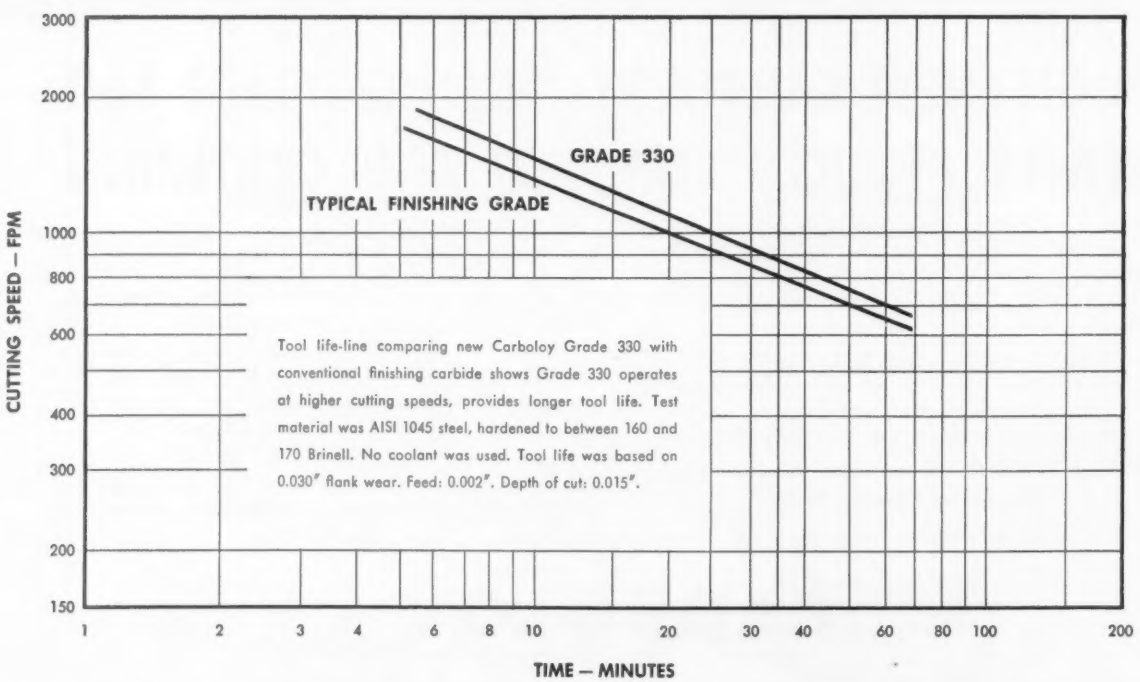
BRAZING CRACKS ELIMINATED

Conventional carbide (Figure 1) shows type of brazing crack that can greatly reduce tool life and increase machining costs.

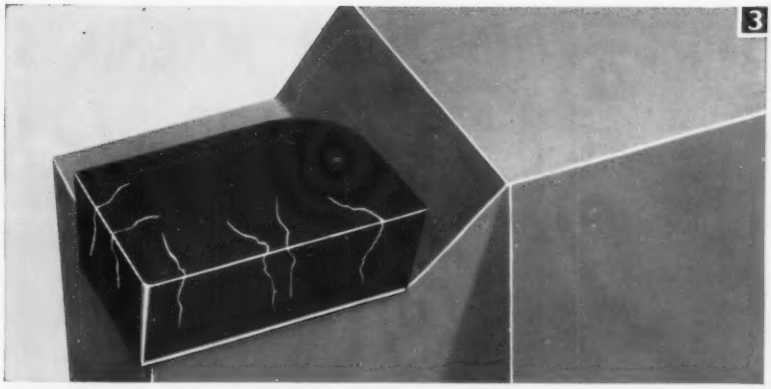
Carboloy Grade 330 (Figure 2) uses nickel binder to provide greater strength and toughness to resist brazing strains. For further protection, the wholly new composition of Grade 330 permits the use of high-silver solders with lower melting points. (Photos have been retouched to bring out brazing cracks difficult to see with the naked eye.)

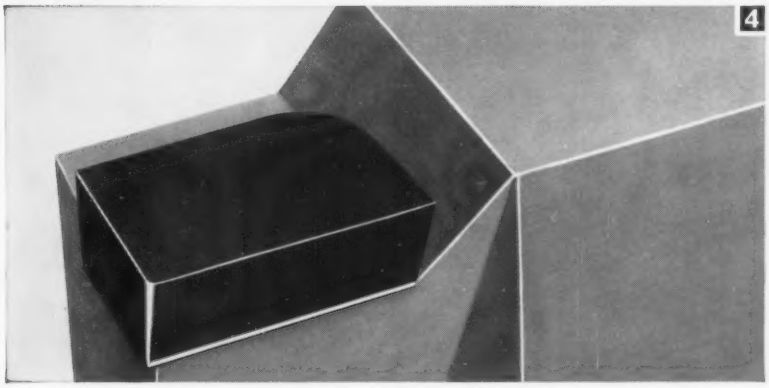


NEW CARBOLOY STEEL-FINISHING GRADE 330



Tool life-line comparing new Carboloy Grade 330 with conventional finishing carbide shows Grade 330 operates at higher cutting speeds, provides longer tool life. Test material was AISI 1045 steel, hardened to between 160 and 170 Brinell. No coolant was used. Tool life was based on 0.030″ flank wear. Feed: 0.002″. Depth of cut: 0.015″.





GRINDING CRACKS ELIMINATED

Ordinary steel-finishing carbides are so brittle that grinding cracks (Figure 3) frequently appear. Automatic grinders cannot normally be used.

Because Grade 330 (Figure 4) has twice the transverse rupture strength of ordinary carbides, it has superior resistance to grinding cracks, can be easily ground on duplicating-type grinders. (Photos have been retouched to bring out grinding cracks difficult to see with the naked eye.)

MACHINES FASTER, WEARS 20-35% LONGER

- **Easier to braze and grind**
- **Double transverse rupture strength**
- **More resistant to chipping, cracking**

With a transverse rupture strength of 200,000 psi, new Carboloy Finishing Grade 330 is nearly twice as strong as conventional steel-finishing carbides.

Used on finishing and boring jobs, this extra strength means greater resistance to chipping and cracking, along with improved tool life.

Entirely new composition

The secret of Grade 330 is its higher titanium-carbide content and nickel binder. Grade 330 is tougher, easier to grind, and more wear resistant than cobalt-binder grades.

Production tests on AISI 1045 steel (see chart at left) show Grade 330 can be operated at speeds 10% higher than other carbides without any loss in tool life. When compared at speeds ranging from 600 to 1900 fpm, Grade 330 consistently provided 20-35% longer tool life than other grades.

Extra-performance steel-cutting carbides

Grade 330 rounds out the Carboloy extra-performance Series 300 carbides (Grades 350, 370), taking up on f...ishing and boring where Grade 350 leaves off.

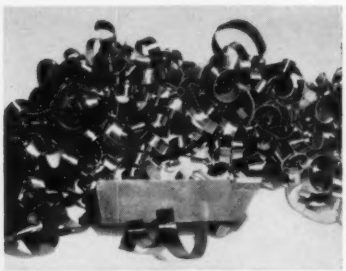
Throw-away inserts, standard blanks, square and solid boring tools are now available from Authorized Carboloy Distributors. For price list and specifications on Grade 330, send the coupon on page 4 of this advertisement.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

For more information fill in page number on Inquiry Card, on page 229

GET MORE OUTPUT FROM YOUR MACHINES WITH CARBOLOY GRADES 350 AND 370

▶ **Remove more steel per minute** ▶ **Reduce downtime and tool costs**



Eighteen pounds of steel (above) are removed per minute by Grade 370 tool at Improved Machinery Inc., Nashua, N.H. Grade 370 roughs and finishes rolls at twice the speeds of previous carbides, lasts twice as long, saves 14 hours per day in labor.

SETUP: Material—Combination of mild and stainless steel. **Speed**—500-800 fpm. **Feed**—0.021" for roughing; 0.016" for finishing. **Depth of cut**—⅝"-¾". **Coolant**—No.

Carboloy Grades 350 and 370 are *extra-performance* carbides. They are specifically designed to take heavier, deeper cuts at faster speeds . . . to provide maximum machine output at lowest tool cost.

Hundreds of in-plant case histories like the one above have proved Grades 350 and 370 consistently outperform, outwear all other steel-cutting carbides.

Greatly increase output

Even on the toughest jobs, these carbides have brought production increases ranging from 30% to 300% . . . reducing the cost per finished piece.

Carboloy Grades 350 and 370 have a built-in structural rigidity that resists edge deformation even at temperatures as high as 1800° F. Their ability to stay on the job longer means less downtime, more production from the machine.

Complete stocks available locally

Try medium-duty Grade 350 and heavy-duty Grade 370 on your steel-cutting jobs . . . and lower your tooling costs.

Your local Authorized Carboloy Distributor maintains complete stocks of both these grades in a wide range of tools, blanks, and inserts. His name is listed in the Yellow Pages of the phone book. For more information, call him today or mail the coupon below.

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

11147 E. 8 Mile Ave., Detroit 32, Michigan

Send me more information on:

- ☐ New Milling Grade 860
- ☐ New Finishing Grade 330
- ☐ Grades 350 and 370
- ☐ Send the name of the nearest Authorized Carboloy Distributor

Name_____

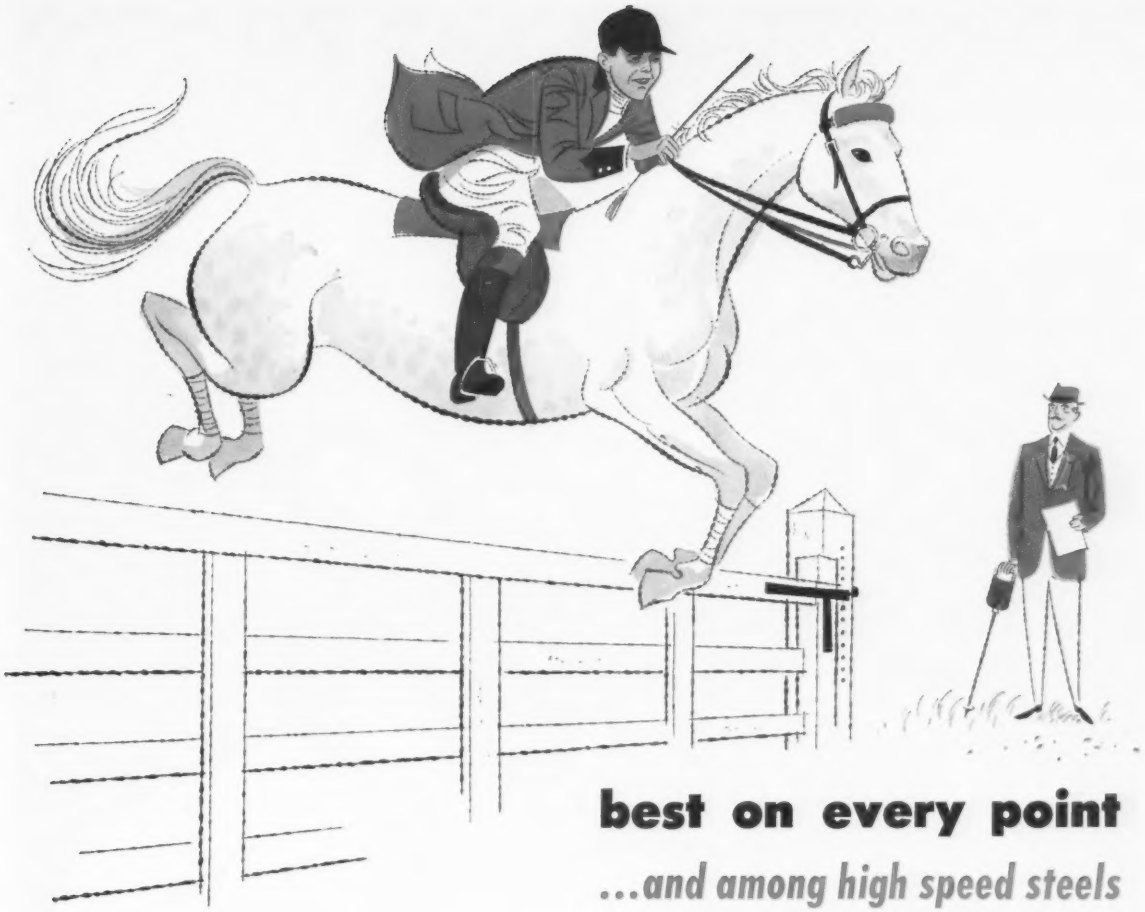
Title_____

Company_____

Address_____

City_____ Zone____ State_____

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company



best on every point

...and among high speed steels the top performer is REX

To leap the hurdle of competition, a product needs performance born of quality. And Crucible's REX® high speed steel has it – in accurate size . . . sound uniform structure . . . dependable response to heat treatment . . . optimum tool performance.

Now, thanks to improved manufacturing techniques, REX is even better – more uniform. Put it to work on your next job, and you'll quickly know why REX is today, as it has always been – *the standard by which all other high speed steels are compared.*

Call for REX at your local Crucible warehouse. Or order it directly for prompt mill delivery. And for a list of available data on REX and other Crucible *special steels*, write now for a free copy of the "Crucible Publication Catalog". *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

For more information fill in page number on Inquiry Card, on page 229

Blanks that machine so beautifully

An expert job of finish-machining is possible only when the blank itself is sound. Bethlehem circular steel blanks have the soundness and strength that enable the machinist to work with complete confidence.

Bethlehem's manufacturing process is unique. Combining both forging and rolling, it produces a blank with uniform density and smooth, regular grain flow. The metal is solid and clean, and it cuts away fast. There is no hidden trouble under the surface that might slow the job or cause rejection.

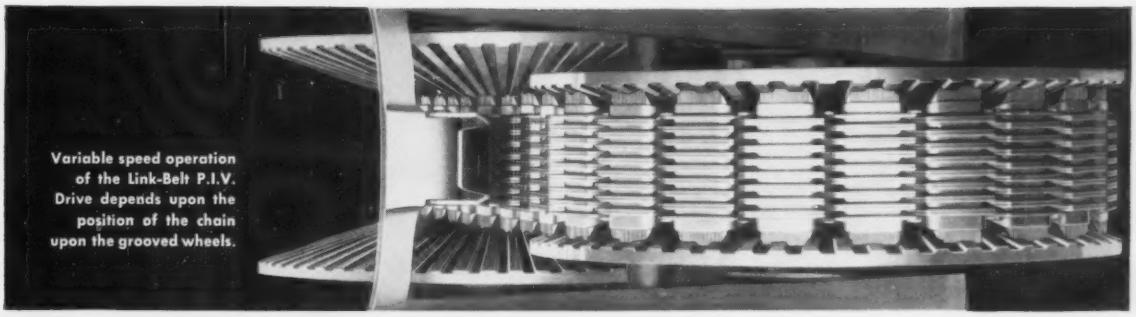
Ask your shop to try these easy-to-work-with blanks. Available in sizes from 10 to 42 in. OD, heat-treated or untreated, they are recommended for gears, crane wheels, clutch and brake drums, sheave wheels, flywheels, pipe flanges, and many other circular steel products.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

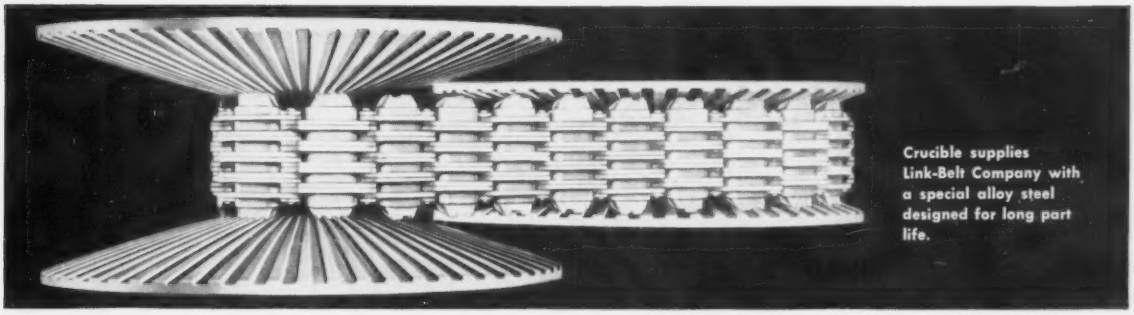
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



Variable speed operation of the Link-Belt P.I.V. Drive depends upon the position of the chain upon the grooved wheels.

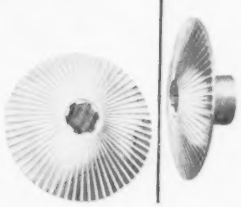


Crucible supplies Link-Belt Company with a special alloy steel designed for long part life.

these

SPECIAL ALLOY STEEL PARTS

keep Link-Belt's P.I.V. Drive on the job



Keeping production operations going at the right speed is the job of this variable speed drive unit produced by Link-Belt Company. Its operation is based on an exclusive drive chain with self-forming metal teeth, which engage with radial grooves in two pairs of cone-shaped wheels.

To make these precision wheels requires a steel that can be readily machined, will not distort, and which has high-strength. That's why Crucible furnishes Link-Belt with a special Nitriding BM alloy steel *designed* for this application. After machining the wheels are Nitrided to obtain a minimum surface hardness of 1000 Vickers Diamond Brinnel – about the hardest surface that can be obtained commercially.

When your application requires a tough, machinable, nondeforming alloy steel – call Crucible. One of our many special alloy grades may be the right one for you – or we can develop one to meet your most exacting demands. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

For more information fill in page number on Inquiry Card, on page 219

How Men and Controls Protect Industry's Confidence in *Carpenter* High Speed Steels

The *performance* you get from high speed steels is directly related to *how* they are produced. As a specialty mill where quality overshadows tonnage . . . and all operations are set to this standard . . . Carpenter devotes the time and attention required to produce high speed steels of the finest quality.

From careful scrap purchasing to guaranteed analysis, and painstaking time and temperature checks during melting . . . through rigid controls of bar reduction in rolling, and many other quality tests at all steps . . . these are the "indispensables" that have enabled Carpenter to produce the finest High Speed Steels for 60 years. And most important is the *personal attention* Carpenter men give to every order. The experience, pride and skill these craftsmen put into the production of every bar make Carpenter High Speed Steels your most dependable investment. Your best proof is to place your next order with Carpenter . . . and see what a difference there *can* be in High Speed Steels. THE CARPENTER STEEL COMPANY, 105 W. Bern St., Reading, Penna.

Every Order of *Carpenter* High Speed Steels Undergoes These and Many Other Quality Controls

- All scrap must be of purest quality, guaranteed analyses.
- Small, electric furnace melting units are used to control quality and uniformity to the highest degree.
- Every heat of steel is constantly checked for chemistry, temperature and melting time.
- Preheat and high heat furnaces are guarded for accurate time and temperature to prepare the steel for rolling.
- Percentage of reduction in cogging billets for rolling or forging of bars is skillfully controlled to assure freedom from internal stresses.
- Discs cut from each bar are acid etched, examined, hardened and fractured to certify internal cleanness, soundness, freedom from excessive segregation. And the hot acid etch is backed by Ultrasonic Testing.
- Slugs are cut from each lot of billets and machined in "step-down" fashion to guard against internal seams, shadow lines, etc.
- Extensive laboratory tests are made for proper hardness, micro-structure, grain size.
- Turning tests are run regularly to check cutting efficiency.
- *For best results, put your confidence in . . .*

Carpenter STEEL high speed steels

NEW OAKITE CLEANERS
GIVE YOU MORE FOR YOUR
PAINT-PREPARATION DOLLAR

Here are 6 ways to end pre-paint metal-cleaning troubles

Does your trouble chart show that you need better cleaners, strippers or surface conditioners?

- ☐ Cleaning solution foams excessively in spray washing machine. See 1 below.
- ☐ Streaky discolorations or powdery residues cling to surface of steel parts being stripped for repainting. See 2.
- ☐ Aluminum parts are severely etched while being stripped of zinc chromate primer or other finishes. See 3.
- ☐ Zinc phosphating process too difficult to control—requires too many titrations, too many additions, etc. See 4.
- ☐ Iron phosphating process doesn't show good results in salt spray tests. See 5.
- ☐ Too many operations—cleaning, pickling, neutralizing, etc.—are needed to prepare steel that does not require phosphating before painting. See 6.

Here are brief descriptions of new Oakite materials designed to end these particular troubles:

1. For a spray washing solution that does not foam at high pressure, try Oakite Composition No. 161. Does not attack aluminum.
2. For stripping pigmented paint, phosphate coatings and undercoat rust *in one operation*, try Oakite Rustripper.
3. For safe, thorough stripping of aluminum, try Oakite Stripper No. 110.
4. For a zinc phosphating process that is truly easy to control, try new Oakite CrysCoat SW. No accelerators, starters or toners. Only one material used for make-up and up-keep
5. For salt spray results far beyond the capacity of ordinary phosphating processes, try new Oakite CrysCoat No. 89.
6. For *one-operation* removal of rust, heat scale, welding residues and light soil together with good preparation for painting, try Oakite Compound No. 131. Inhibited against attack on steel.

FREE Check the coupon and we will send you free booklets or bulletins containing complete information on the new Oakite materials in which you are interested.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
SCIENCE

Technical Service Representatives in Principal Cities of U. S. and Canada

Export Division Cable Address: Oakite

OAKITE PRODUCTS, INC.
26 Rector Street, New York 6, N.Y.

Send me free booklets or bulletins giving complete information on the new Oakite materials checked below:

- ☐ Oakite Composition No. 161
- ☐ Oakite Rustripper
- ☐ Oakite Stripper No. 110
- ☐ Oakite CrysCoat SW
- ☐ Oakite CrysCoat No. 89
- ☐ Oakite Compound No. 131

Name _____

Company _____

Address _____

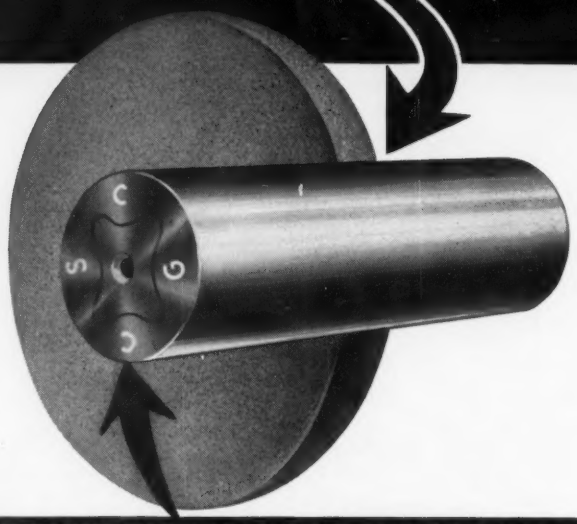
For more information fill in page number on Inquiry Card, on page 229

An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight, smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002″ on diameters 1-1/8″ to 2-7/16″ inclusive . . . plus nothing to minus .003″ on diameters 2-1/2″ to 8″ inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 INCORPORATED 1892

For more information fill in page number on Inquiry Card, on page 229

"IT'S BETTER IF IT CONTAINS MOLY"

Moly carburizing steels with 0.5% Mo are a natural for components like this automotive ring-gear and pinion. They have outstanding properties that suit them to the demands of gearing and similar applications, such as, superior case hardness, low distortion and good machinability. Many features of these new carburizing steels are discussed in a recent technical article. For a reprint, write Climax Molybdenum Company, 500 Fifth Avenue, New York 36, N. Y., Dept. 13.

Molybdenum Carburizing Steels

MOLYBDENUM OFFERS THE ECONOMICAL KEY TO PERFORMANCE

Over the years, molybdenum carburizing steels have proved their merits in scores of applications and at every level of production.

Design engineers know moly steels for their uniform hardenability, toughness and wear resistance.

Production men know that moly steels are easy to heat treat, easy to machine.

Management knows that moly steels mean economy in fabrication, high performance in a wide range of end products.

Standard molybdenum carburizing steels are widely available. Higher moly analyses may be ordered in heat lots from a number of leading suppliers.

CLIMAX MOLYBDENUM

Use the Moly Key to better carburizing steels

- High case hardness
- Wide choice of hardenability
- Easy to heat treat
- Low distortion
- Good machinability
- Good wear resistance

TRY and COMPARE

PANTHER 5 TOOL BITS FOR YOURSELF

Here's what you GET in Panther 5 . . . A high-carbon, high-vanadium, tungsten-bearing high speed steel with 5% cobalt. Its analysis is designed to give this grade the highest red-hardness and abrasion-resistance of *any* high speed steel.

Here's how it can HELP you . . . This combination of highly valuable properties gives Panther 5 exceptional ability to resist wear, yet it also possesses good toughness and edge strength. Put Panther 5 Tool Bits on your heavy-duty jobs and abrasive materials—*watch them step up your production runs between grinds!*

Stocked in ALL SIZES . . . Panther 5 Tool Bits are produced as a finish-ground product. They're carried in stock for immediate shipment in nine sizes of squares, from ¼" x 2½" long to 1" x 7" long . . . and in eighteen sizes of flats, ranging from ⅜" x ¼" x 3" long to 1½" x ¾" x 7" long. ● *Why not get in a trial order—see for yourself what they'll do!* Check your nearest AL representative or distributor . . . or write ***Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.***

Valuable Data for PRODUCTION MEN ... yours for the asking

1. **"HIGH SPEED TOOL BITS"**
   Handy data on the complete AL line, comprising eight different grades of high speed steel tool bits. Includes shop handling, heat treat methods, etc.

2. **"CUTTING TOOL MATERIALS"**
   This 36-page booklet analyzes and compares all AL grades of cutting tools: carbon and high speed steel, cast alloy and carbides. Includes data on handling and treatment.

ADDRESS DEPT. M-78

For complete **MODERN** Tooling, call

Allegheny Ludlum

AL® FINE TOOL STEELS SINCE 1854

WAD-5584

The gears in an automatic nut former have to be tough and strong to withstand heavy, varying loads. Yet, the castings from which they're made should be easy to machine. That's why this gear for a Waterbury Farrel Automatic Nut Former is made from ASTM-50 gray iron with a nominal composition of 1 % nickel and .50 % molybdenum.

Moly gives cast iron gears higher strength with toughness and good machinability

"To insure a tough, easily machined gray iron for the gears in our Automatic Nut Formers," says Henry C. Griggs, Metallurgist for Waterbury Farrel Foundry & Machine Co., "we specify .50% molybdenum in our ASTM-50 material. The properties of this material contribute importantly to the reputation of Waterbury equipment for accuracy and high speed production under severe operating conditions."

Molybdenum helps to give reliable and reproducible castings — very important factors in consistent performance of gears.

Investigate moly irons. They may be the key to better performance in many of your gear applications.

For the first two in a series of bulletins, "Why Moly Iron," or for technical assistance, write Climax Molybdenum Co., Department 13, New York 36, N. Y.

CLIMAX MOLYBDENUM

Half Mile of Hot Weld Flash Trimmed Per Grind

HAYNES STELLITE alloy cutting tools trim red hot weld flash from 3200 automobile wheel blanks without chipping, spalling, or losing their sharp cutting edges. The temperature of the weld is at 1500 deg. F as the tools slice through the flash. During the operation, the tools are subjected to thermal shock as they come in contact with the hot metal . . . and to severe impact as they cut through chilled sections and irregular weld surfaces. Yet they remain in operation for a full 8-hour shift.

Three HAYNES STELLITE alloy tools are used on this job. One rough machines the weld and the following two take finishing cuts. They remove 10½ in. of flash from each wheel blank, and trim a half mile of flash per grind.

HAYNES STELLITE tools remove metal fast. They can be used at high speeds with comparatively high feed rates, and they take deep cuts. They have good impact strength, high compressive strength, and retain their hardness at red heat temperatures. This combination of properties makes them extremely valuable on any machining job.

For information on how HAYNES STELLITE tools can help you speed up your machining operations, write for the booklet "HAYNES STELLITE Metal-Cutting Tools." It gives helpful information on chip formation, tool design, grinding procedures, and the machinability of metals.

"Haynes" and "Haynes Stellite" are registered trade-marks of Union Carbide and Carbon Corporation.

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

UCC

General Offices and Works: Kokomo, Indiana

Sales Offices

Chicago • Cleveland • Detroit • Houston • Los Angeles • New York • San Francisco • Tulsa

For more information fill in page number on Inquiry Card, on page 229

Tool Steel Topics

BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

Airplane Builder's Change to Bearcat Increases Life of Rivet Sets 5 Times

At the Wichita, Kans., plant of Boeing Airplane Company, rivet sets used on the B-47 and B-52, as well as other types of aircraft, had been providing satisfactory results. But, Boeing engineers reasoned, by checking the performanec of other grades of tool steel in the same application, they might discover a tool steel that could do a better, more economical job.

So they ordered Bearcat, from Ford Steel Company, their Bethlehem tool-steel distributor in St. Louis. The results were impressive. The Bearcat sets gave five times longer service life then the sets previously used. In addition, the heads also drove down better, thus minimizing time lost in reworking, and facilitating ready acceptance by Boeing inspectors. Besides, with Bearcat's superior finish, there was less surface pick-up.

Bearcat is our super-tough, air-hardening general-purpose grade. It has exceptional resistance both to shock and to wear. Its air-hardening characteristic minimizes quenching hazards, and provides excellent resistance to distortion in heat-treatment.

In addition to rivet-set applications, Bearcat can be used advantageously for punches, chisels, hot headers, gripper dies and master hobs, as well as for dies used in blanking and bending, and cold-forming.

If you'd like to know more about Bearcat, or perhaps try it out in your shop, just get in touch with the nearest Bethlehem tool-steel distributor.

BETHLEHEM TOOL STEEL ENGINEER ASKS:

How Hard Should Tools Be?

It is sometimes difficult to determine the best hardness for certain tools. As all tools are subjected to wear it is ordinarily desirable to use the highest possible hardness. With most tools, this causes brittleness or breakage, making some compromise necessary. Generally speaking, tool hardness should be lowered from the maximum to a degree which causes the tools to consistently wear out in service, rather than fracture. The optimum hardness for a given type of tool often varies considerably, depending upon the operating conditions. However, here are the average hardnesses of commonly used tools:

TOOL	HARDNESS ROCKWELL C
High-speed steel, metal-cutting tools, single point	65
High-speed steel, metal-cutting tools, multiple point	63
Blanking dies	60
Forming dies	60
Drawing dies, hardened all over	60
Drawing dies, bore-hardened only	66
Gages	60
Shock-resisting tools (punches, etc.)	58
Hot-work tools	40/50
Cold shear blades	60
Hot shear blades	48
Tools subjected to max tensile loads (cylinders, containers, etc.)	53
Tools subjected to max compressive loads (plungers, punches, etc.)	60/65

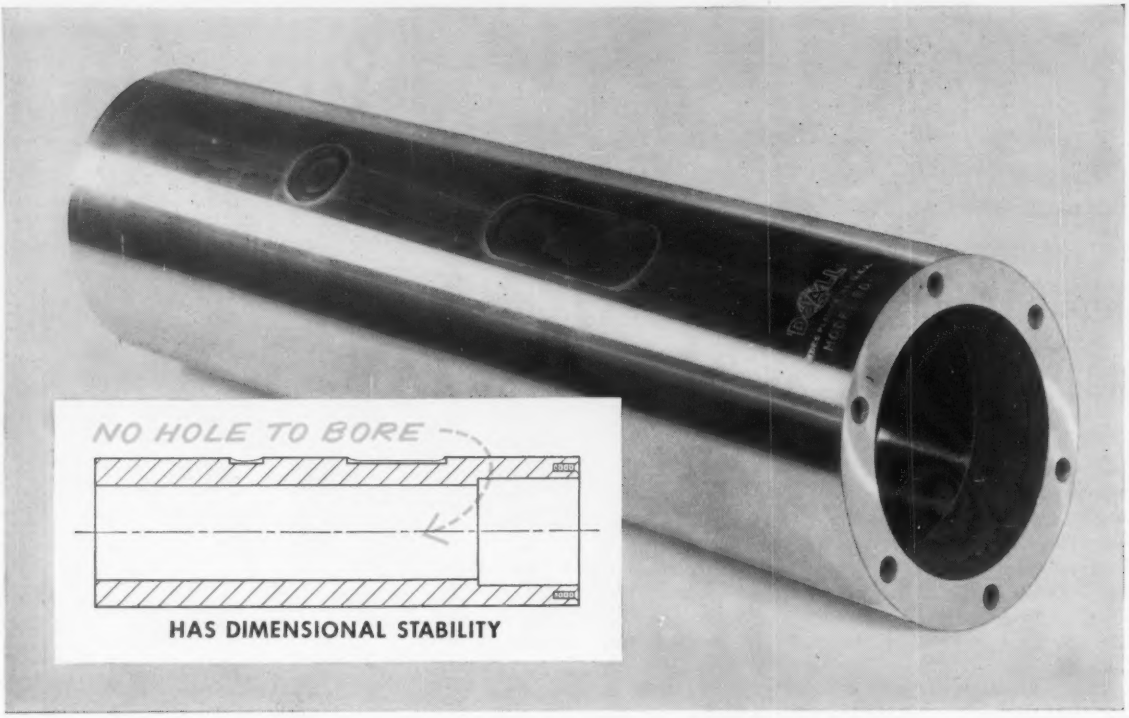
These hardness figures should be used as a guide only, because for individual jobs the required hardness may be slightly higher or lower, depending upon circumstances.

Tool Steel Color Film An Award Winner

"Teamwork," Bethlehem's 16-mm color film on tool steel, received an award for excellence in the sales promotion field at the recent Columbus Film Festival, held at Columbus, Ohio. The film, being received enthusiastically in all parts of the country, shows the manufacture of Bethlehem tool steels, and explains the reasons behind their quality control and heat-treatment. Typical applications of various grades are included.

The picture runs for 30 minutes. It is available for showings to machinists, diemakers, heat-treaters, machine-tool manufacturers and distributors. Its subject matter makes it excellent for technical society meetings, and for showings to engineering-student groups.

If you would like to see "Teamwork," drop a line to Publications Department, Room 1001, Bethlehem Steel Company, Bethlehem, Pa. If possible, please select a showing date well in advance, to permit adequate time for scheduling and shipping.



DoALL switches to TIMKEN® seamless steel tubing —cuts spindle housing cost 26%

THE DoALL Company faced a tough problem in reducing production costs of its precision spindle housing, while retaining the required dimensional stability. Timken Company metallurgists came in, worked with DoALL's engineers and recommended a change from the bar stock previsously used to Timken® seamless steel tubing.

Immediate savings resulted. Machining time was cut. With Timken seamless tubing, the hole was already there. No drilling required. Scrap loss reduced. More parts produced per ton of steel. One of the annealing operations required with bar stock was eliminated.

DoALL and Timken Company metallurgists devised stress-relieving operations to insure complete stability in the finished part. By changing to Timken seamless steel tubing, DoALL's production cost per housing was cut 26% and thorough lab tests proved there were no dimensional changes in the finished part.

Timken Company metallurgists will gladly work with you on your hollow cylindrical parts jobs, to help you make important production savings with Timken seamless steel tubing. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

For more information fill in page number on Inquiry Card, on page 229

now...

ONE COMPLETE REFERENCE FOR YOUR ONE SOURCE OF DIE-SET ACCESSORIES

More than 200 pages featuring the all-new "LEADERSHIP LINE"

Danly's new "Leadership Line" of die sets and diemaker's supplies is a major development in the stamping industry – certain to affect every toolroom and die shop in the country.

That's why Danly's new catalog is a must for every tool engineer's technical library . . . specially edited and arranged to present complete dimensional data. Easy-to-read tables . . . convenient product illustrations and drawings . . . clear indications of all optional features make it a real working tool. Includes all Danly Die-Sets, Die-Set Accessories, Diemakers' Supplies, Bolster Plates and Bolster Accessories making up Danly's all new "Leadership Line". Easy to look at – and easy to get . . .

DANLY®

DIE SETS AND DIEMAKERS' SUPPLIES

WRITE FOR YOUR FREE COPY TODAY!

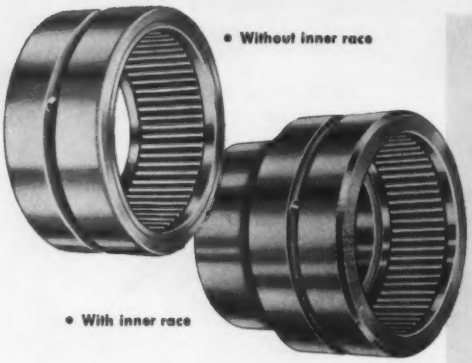
DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue, Dept. C Chicago 50, Illinois

ORANGE NEEDLE BEARINGS

—offer widest choice of types and sizes to match your design needs

—greater opportunity to simplify design—fight friction—meet load requirements—save space and cost.



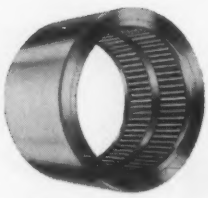
• Without inner race

• With inner race

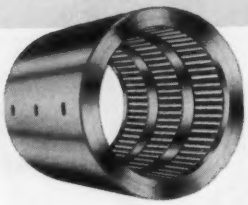
ORANGE *Full Type* ROLLER BUSHINGS

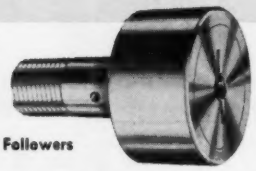
Maximum load capacity in small space

Orange Roller Bushings are full-type needle bearings for heavy-duty service. Rollers and races made of finest bearing steel—hardened, ground and finished to highest precision standards for durable, friction-free operation. Exacting control of roller uniformity by electronic gauging, permits closer internal running clearances, minimizing possibility of misaligned rollers. Complete range of stock sizes from ½" to 8" shaft diameters.



• Two and three row types for extra heavy duty





• Cam Followers

ORANGE *Cage Type* NEEDLE BEARINGS

Permanent alignment of rollers prevents skewing

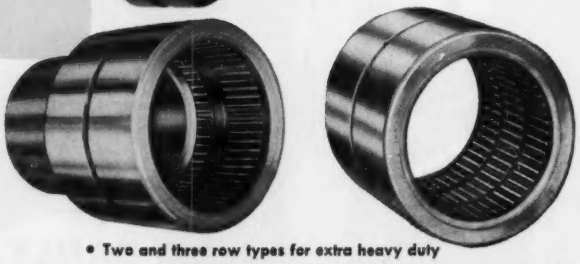
Anti-friction cage keeps rollers permanently aligned and true-running in any position—vertical, tilted, horizontal. Successful on overhung mountings and relatively high-speed installations. Less affected by misaligned mountings or uneven loading. Extremely smooth, quiet running. The answer to many applications unsuited for conventional needle bearings. Wide choice of sizes from ½" to 8" diameter.

• Without inner race

• With inner race

• Sealed Type with built-in seal eliminates need for seals in housing

WRITE for new 40-page Engineering Reference Manual M-55 giving complete details of construction, dimensions, capacities, etc.



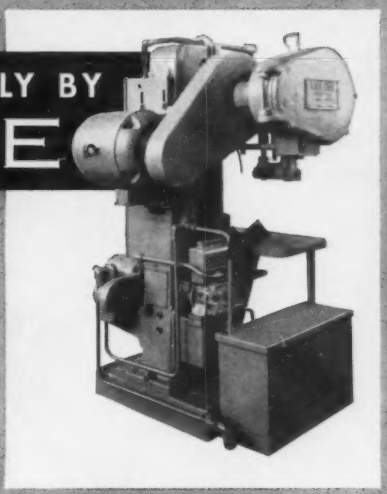
• Two and three row types for extra heavy duty

ORANGE ROLLER BEARING CO., INC., 552 Main Street, Orange, N. J.

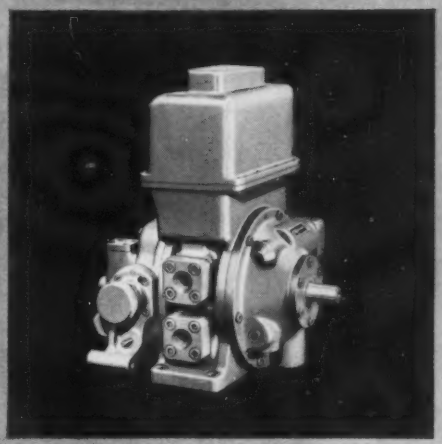
For more information fill in page number on Inquiry Card, on page 229

OILGEAR "JK" FEED PUMPS

USED EXTENSIVELY BY MOLINE



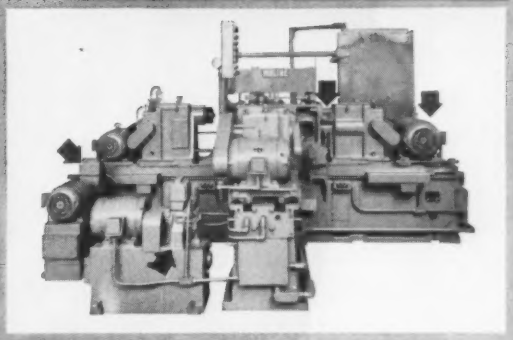
Above, Moline Drilling Machine employing "JK" Feed Pump.



The Moline Tool Company, long established and respected in industry, has used Oilgear Fluid Power Feeds since 1925. Of Oilgear "JK" Fluid Power Feed Pumps used in its machines, Moline says these pumps *combine* the advantages found only in part in various mechanical feeds. Also, the "JK" Feed Pump provides infinitely, steplessly variable speeds; you can easily find the speed best suited to the work or condition of tools. Traverse speed can be as much as 265 times the feed rate. Coarse and fine feed rates are variable over a 20 : 1 range. Cycle time is cut drastically, production increased, costs reduced. Feed rates are maintained accurately despite varying work pressures by a built-in automatic pressure compensator.

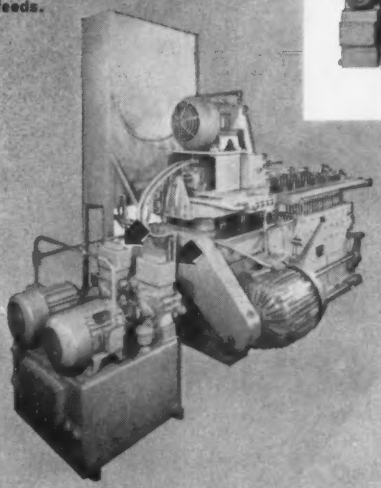
"JK" Feed Pumps are simple, compact, electro-hydraulically controlled units, easily installed nearby or remotely. Systems need only a pump with reservoir, a double-acting cylinder, standard control and two easily connected pipes. Eliminating expensive engineering, these units can simplify design, reduce manufacturing cost, improve performance and increase saleability of machines. Manual, semi-automatic or full automatic operation. Available now in 4 sizes. Write for free literature.

THE OILGEAR COMPANY
1569 West Pierce Street
Milwaukee 4, Wis.

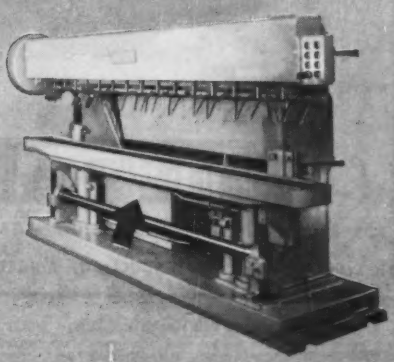


Moline 4-way horizontal boring machine uses 4 Oilgear "JK" Feed Pumps.

Below, Moline special 56-spindle back-spotfacing machine using 2 "JK" units for vertical and horizontal feeds.



Below, Moline ten-foot, straight-line drilling machine using "JK" Feed Pump.



"JK" PUMPS EASILY APPLICABLE TO YOUR MACHINES FOR BETTER PERFORMANCE

JIC

PIONEERS . . . NOW THREE PLANTS FOR FLUID POWER

OILGEAR
Fluid Power

PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS AND VALVES

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

STABLE ACCURACY

The Most Important Requirement In Gaging

The basic design of the Dimensionair is different from that of any other Air Gage. It "repeats" measurements precisely and constantly hour after hour because —

1. The Dimensionair's balanced air system cancels out pressure variations which might affect it and cause errors.
2. Unlike other air gages, there is no adjustment in the magnifying-measuring side of the system. Rather than introduce a variable here which would make a fixed system impossible, Federal offers two magnifications which answer practically every requirement. These magnifications are 2500 to 1 and 5000 to 1. In this way, Federal achieves a stability which cannot be approached by other air gages.
3. Because the magnification is fixed, the scale is linear and the graduations can be accurately calibrated.
4. Hence, with no adjustment to change the magnification and affect the stability, only a single master is required.

Try It!

Check a Dimensionair yourself right in your own plant. Compare it with your present air gages.

a. **Check it for stability** or "repetition". Do this frequently and over long intervals, always using the same master. Avoid temperature effects (excessive handling, direct sunlight, etc.) Notice how quickly you can set the gage to zero.

b. **Check its calibration** using any number of masters. Confirm the fact that only one master is needed. See how dependable the Dimensionair really is.

Ask us or our salesmen to let you try a Dimensionair

Federal Products Corporation
6116 Eddy Street • Providence 1, R. I.

We'd like to test a Dimensionair in our plant.

Company Name .....

Your Name ..... *Title* .....

Address .....

.....

For more information fill in page number on Inquiry Card, on page 229

ANOTHER EXAMPLE OF VICKERS® Hydraulics

LeBlond Automated Crank Turning Equipment completely turns and faces over 55 V8 crankshafts per hour. One operator can handle two such machines.

in AUTOMATION

This new LeBlond Automated Crank Turning Equipment machines crankshafts at an exceptionally high rate. All operations of the Models LBA and PBA machines shown above are hydraulic with the exception of the actual rotation of the crank . . . here a Vickers hydraulic motor is used for braking and jogging the electric motor drive. All hydraulic power is supplied by Vickers Pumps and controlled by Vickers Valves.

In addition to the advantages inherent in hydraulic control, Vickers Hydraulics gives you the benefits of a nation-wide and full-time field engineering and service organization to assure correct application and operation with least maintenance. Vickers has the complete line of hydraulic equipment necessary to take undivided system responsibility . . . to eliminate any risk of incompatibility of hydraulic components.

The Vickers Application Engineer near you will be glad to demonstrate the many benefits you can obtain by using Vickers Hydraulics. Write for a copy of Catalog 5001A.

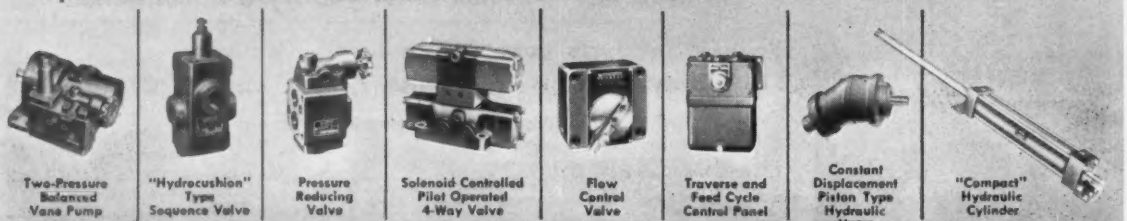
VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

ADMINISTRATIVE and ENGINEERING CENTER
DEPARTMENT 1403 • DETROIT 32, MICHIGAN
Application Engineering Offices:
ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DETROIT
HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS
NEW YORK AREA (Summit, N.J.) • PHILADELPHIA AREA (Media)
PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE.
ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley)
SEATTLE • ST. LOUIS • TULSA • WASHINGTON • WORCESTER
IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

7301

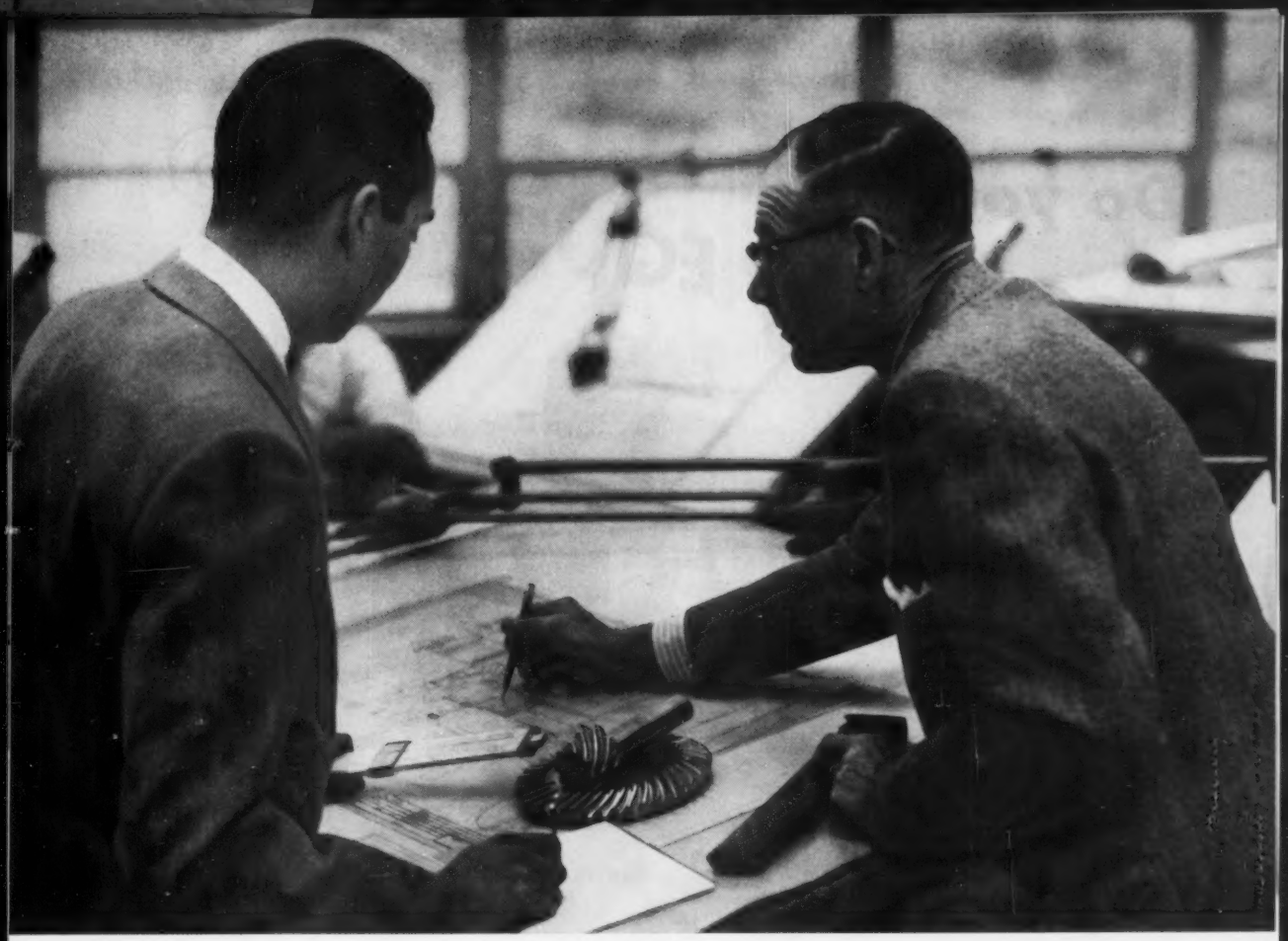
Representative Standard VICKERS Units Used on LeBlond Automated Crankshaft Lathe



Two-Pressure Balanced Vane Pump | "Hydrocushion" Type Sequence Valve | Pressure Reducing Valve | Solenoid Controlled Pilot Operated 4-Way Valve | Flow Control Valve | Traverse and Feed Cycle Control Panel | Constant Displacement Piston Type Hydraulic Motor | "Compact" Hydraulic Cylinder

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

For more information fill in page number on Inquiry Card, on page 229



Unitool*. . . *a fast, easy, low-cost way* to produce prototype bevel gears!

Now you can produce small quantities of spiral bevel, Zerol® bevel and hypoid gears with a comparatively small capital outlay and without specially trained personnel.

You can reduce the time and expense it takes to change your angular drive from a drawing board idea to a working model, too, because the Unitool Method produces good quality gears directly from the initial calculations.

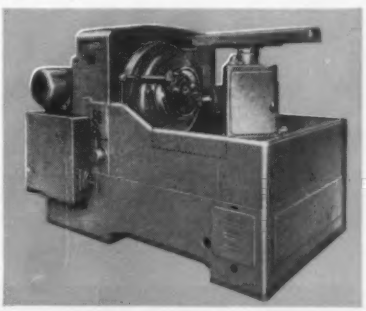
The Unitool Method is based on a fundamentally different theoretical approach to bevel gear generation. Only six different cutters are required to cut gears up to 14" pitch diameter—spiral bevel and Zerol bevel pairs of any ratio; hypoid pairs 3:1 ratio and higher. Because these cutters have a wide overlap in range, cutter diameter is not critical.

Calculations are short enough and easy enough for you to do in your own plant. Correct tooth thickness and position of contact are easily determined without requiring special operator training.

The Unitool Method is designed especially for the Gleason No. 106 and No. 116 Hypoid Generators which feature increased universal cutter tilt.

*Trademark

We will be glad to send further information on the Unitool Method and the two Gleason Generators best suited for it at your request.



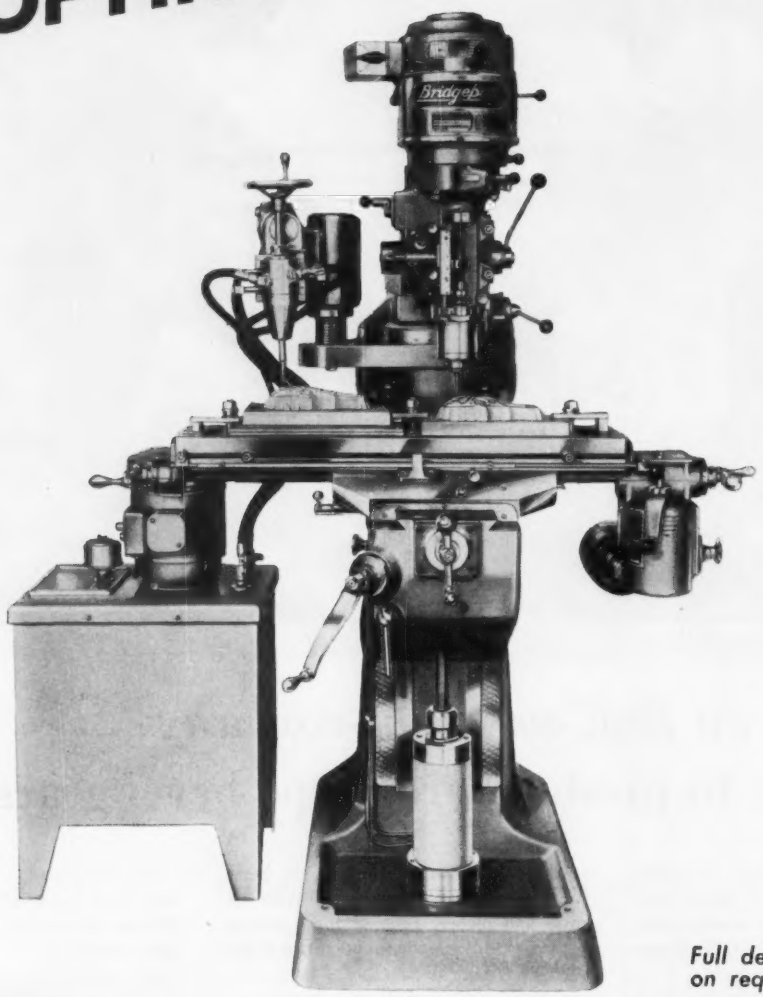
The Gleason No. 106 Hypoid Generator is a high-speed machine for spiral bevel, Zerol bevel and hypoid gears up to 8½" pitch diameter. Its larger counterpart, the No. 116 Hypoid Generator, handles the same type gears up to 18" pitch diameter.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

Do you need COPYING EQUIPMENT?



Full details on request.

The Bridgeport True Trace combination will give excellent performance and save endless hours when copying irregular dies and moulds.

The stylus mounting fits between the column and the turret and is suitable for either right hand or left hand installation on new or old machines.

The stylus assembly swings out of the way so there is no interference when machine is used for conventional milling.

Bridgeport MACHINES, INC.

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

For more information fill in page number on Inquiry Card, on page 229

"AMERICANS" WORKING FOR NORDBERG

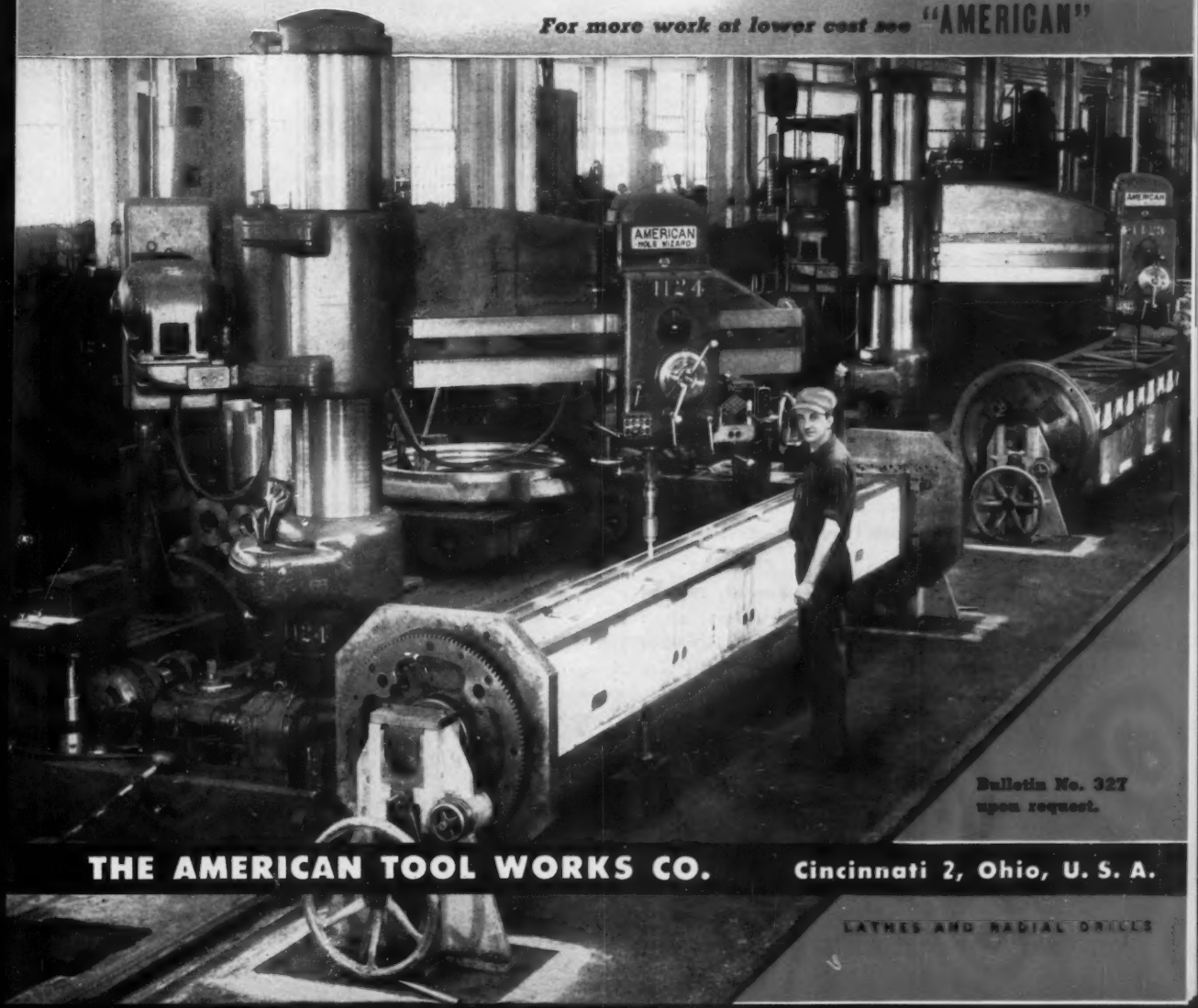
helping to profitably produce the quality products for which Nordberg Manufacturing Company of Milwaukee, Wisconsin is known the world over.

These "AMERICAN" Track Type Hole Wizard Radials mounted on mobile bases speed up drilling, tapping and boring operations in long, heavy work pieces by bringing the tool to the work rather than moving the work to the tool.

The work pieces are mounted in elaborate trunnion jig fixtures so different work planes may quickly be presented to the tool and a high degree of accuracy maintained.

The quality of Nordberg products is universally recognized. We are proud indeed that so many "AMERICAN" Lathes and Radial Drills contribute to it.

For more work at lower cost see **"AMERICAN"**

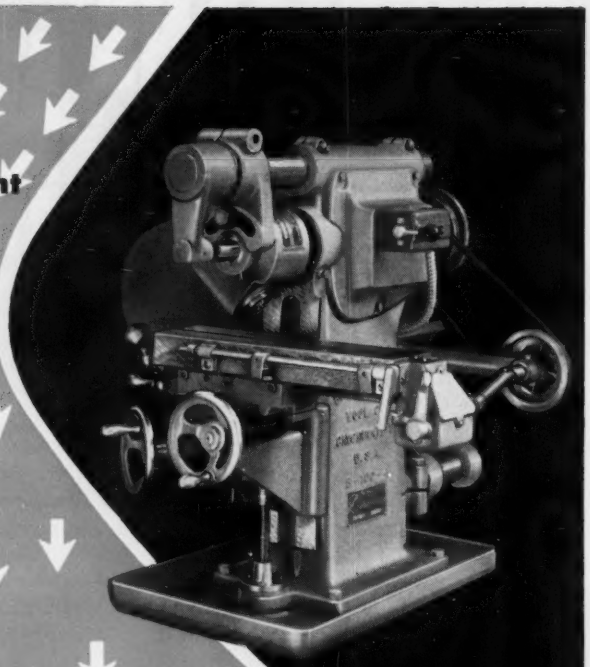


Bulletin No. 327 upon request.

THE AMERICAN TOOL WORKS CO. **Cincinnati 2, Ohio, U. S. A.**

LATHES AND RADIAL DRILLS

Small parts bottlenecks strangling your milling department ?



U·S·Burke

MILLING MACHINES

Free Big Mills for Big Jobs!

No. 1 U. S. MILLING MACHINE

The top-quality precision mill, economically priced! May be hand operated, or equipped with air-hydraulic feeds for high production applications.

This accurate and simple-to-operate mill brings small part production into balance, with low-cost operation that avoids wasted time and investment in big mills.

Excellent for keyways, quantity runs of small pieces, such as sectors, short racks, simple profiling, sawing, slotting, squaring, cut-off, short-run splining, even light slab milling.

BURKE BENCH MILLERS

Here's small part milling accuracy for either toolroom or production uses. Choose between 2 hand and 2 power feed models.

Rugged frame, hand scraped thruout, Timken bearings . . . in a time-tested design that provides accurate milling, drilling, sawing, boring, facing and slotting of small parts.

Wide range of speeds handles any material. Dependable performance and ease of set-up lower operational costs on all types of small parts. Vertical Milling Attachment and complete range of other accessories available.

Write for complete specifications and prices

U·S·Burke MACHINE TOOL DIVISION
17 Brotherton Road • Cincinnati 27, Ohio

Manufacturers of the U. S. Vertical Milling Machine and the radically new U. S. Quartet

SUPERFINISH BORES REDUCE TOOL WEAR
KNURLED HEADS PROVIDE GOOD GRIP
UNIVERSAL DRILL BUSHINGS
industry's standard of quality and service
100% CONCENTRICITY AND HARDNESS TESTS INSURE ACCURACY
BLENDED RADIUS HELPS PREVENT TOOL HANG-UP
UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH MICHIGAN
U

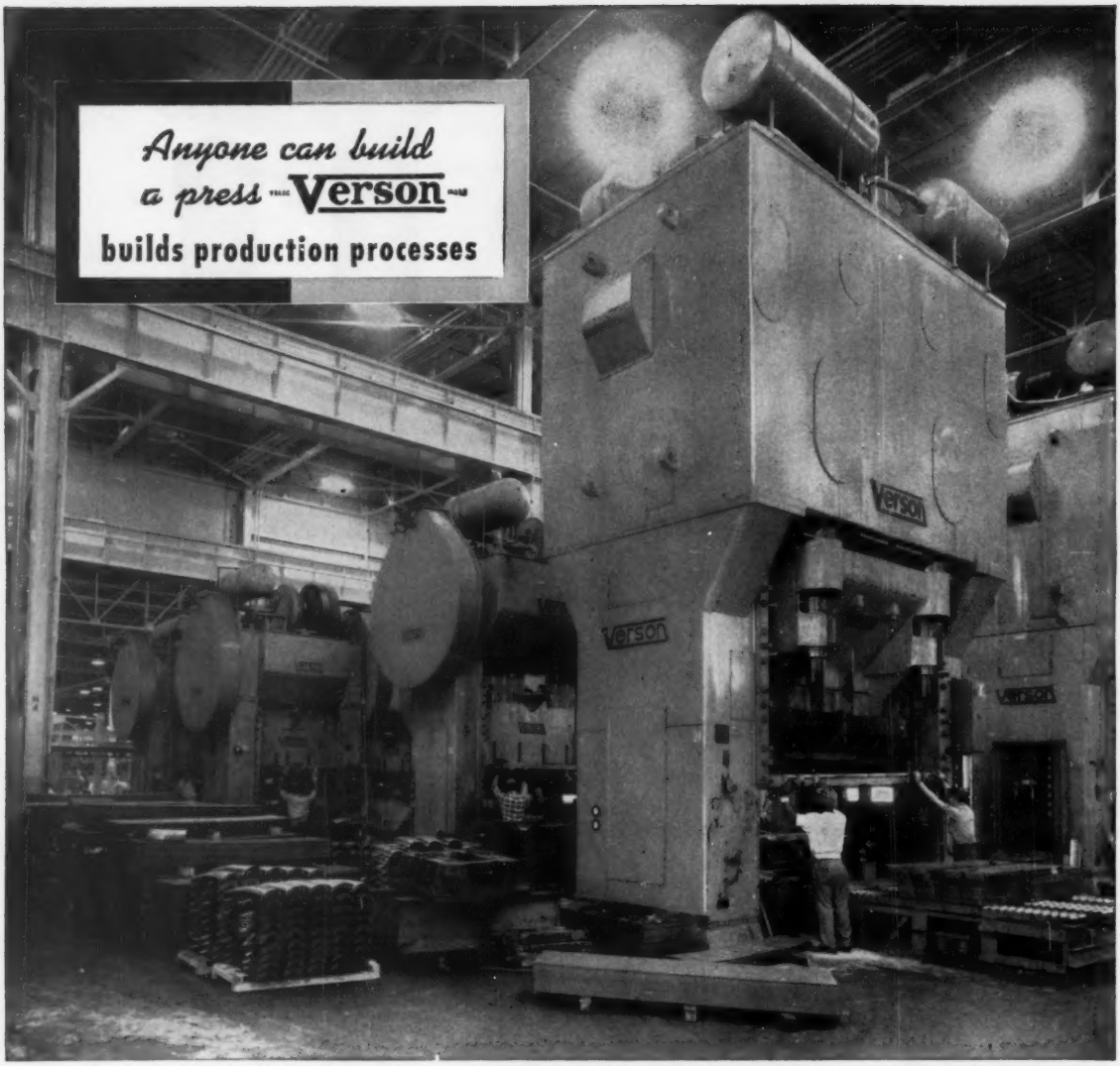
Universal Drill Bushings are available in a complete range of standard sizes and lengths. Special sizes made to order. Vastly increased production facilities assure immediate deliveries. Write to the office nearest you, Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.; or the home office.

Universal products include: Standard Collet Chucks, Floating Collet Chucks, Boring Chucks, "Kwik-Switch" Tool Holders, Mikro-Lok Boring Bars, Standard Drill Bushings, and Universal Index Plungers. Write for catalog.

189

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 2, MICHIGAN



2500 ton DOUBLE ACTION PRESSES... key units in this 100%

Verson

press room

In the plant in which this photograph was made, 47 Verson presses are now in service and preparations are being made for seven more . . . a 100% Verson-equipped production process!

Building production processes is Verson's business. Anyone can build a press . . . it's what that press can be made to do as a part of an integrated process that is important. In over thirty years Verson has produced processes incorporating virtually all types of standard and special presses. All of this experience and know-how goes into every press that Verson builds.

Whatever your production problems, if they involve the press forming of metals, bring them to Verson. Here your press requirements will be treated as an integrated part of your whole production process. As a manufacturer of practically every type of press we can recommend, without prejudice, the combination of machines that will best fit your over-all requirements.

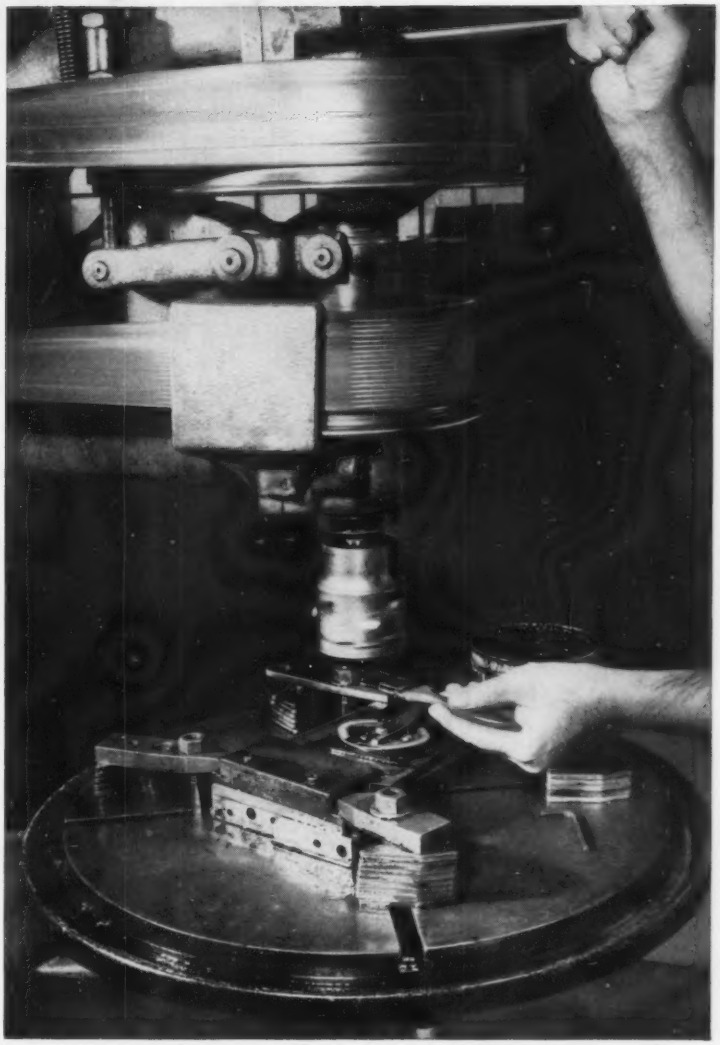
To put these facilities to work for you, just send an outline of your needs.

VERSON ALLSTEEL PRESS CO.

9309 S. Kenwood Ave., Chicago 19, Illinois • South Lamar at Ledbetter Drive, Dallas, Texas

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TOOLING •
CUSHIONS • VERSON-WHEELON DIRECT ACTING HYDRAULIC PRESSES

"INCREASED TAP LIFE FROM 250 TO 4000 PIECES"



Cities Service Chillo Cutting Oil produces astounding results for C.S.S. Machine & Tool Company, Philadelphia, Pa.

Metal stamping . . . precision grinding . . . machining . . . stud welding . . . tool and die making. These are some of the expert operations performed by the 120 skilled employees of C.S.S. Machine & Tool Company of Philadelphia . . . operations based on many years' knowhow and teamwork. And for the past year, with Cities Service cutting fluids, this work has been done with even greater precision, greater efficiency than ever before.

In its tapping operation, for example, C.S.S. increased tap life from an average 250 pieces to over 4000 pieces with Cities Service Chillo Cutting Oil. And in a drilling operation with its Brown and Sharpe Automatics, time required to make one piece was cut from 240 to 165 seconds!

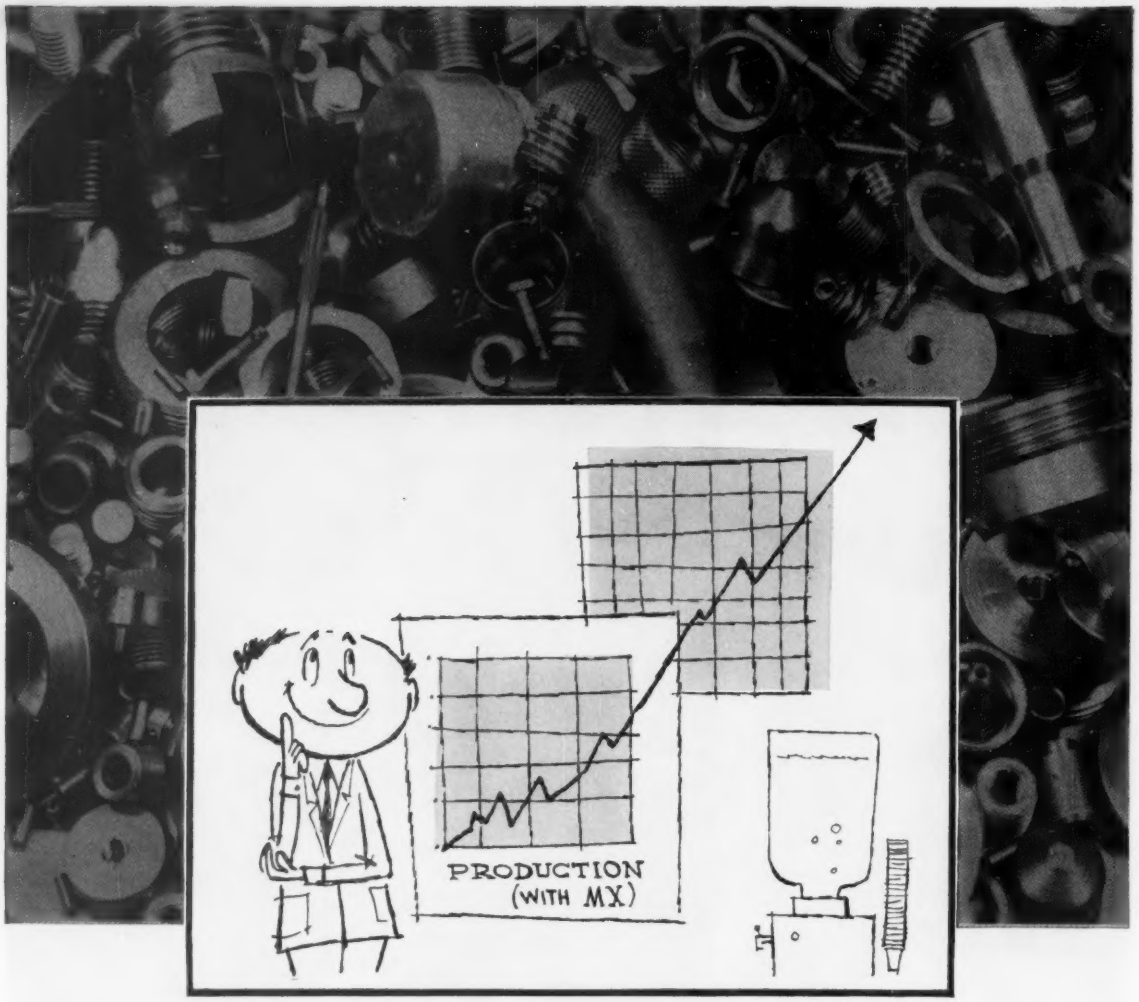
Says President F. G. Schutz: "Cities Service Chillo Cutting Oils are the best we've ever seen. Likewise, Cities Service Lubrication Engineers. It's wonderful to deal with someone who knows our operation so well and has products that help improve it."

If you have a lubrication problem, or even if you're running smoothly, talk with a Cities Service Lubrication Engineer. He's known for solving problems, known for making smooth operations still smoother. Or, if you prefer, write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

For more information fill in page number on Inquiry Card, on page 229



PLEASANT THINGS HAPPEN when you put USS Free-Machining MX Steel to work. You'll find that you can use cutting speeds as much as 50% greater than the speeds at which regular Bessemer grades are normally run. Your production will increase from 10 to 50%. Tools will last up to twice as long. Part finish will be better. And you'll have fewer rejects.

What's more, USS MX has so consistently outperformed ordinary screw stock that we can promise you with complete confidence that *MX will cut the cost of any part* you now machine from regular Bessemer grades. It's been proved in hundreds of shops.

And here's another reason why MX is your best buy today. USS Free-Machining MX has been successfully machined at speeds up to 350 SFM—speeds far higher than the average (under 250 SFM) used in most shops today . . . yet it costs no more than ordinary screw stock.

Switch to MX. Produced in all the popular screw stock sizes, this production-boosting, cost-reducing steel is sold in cold-finished form by your regular supplier, either as "MX" or under his own identifying trademark. In hot-rolled form, MX is available direct through our nearest district sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Bigger output . . . longer tool life . . . lower costs

USS

—when you do the job with free-machining

MX

UNITED STATES STEEL

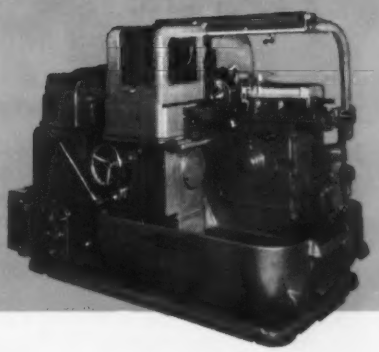
TAREX

AUTOMATICS

. . . here's JUST ONE of the salient features of this machine which is made with SWISS PRECISION throughout:

FOUR ROBUST SLIDES!

The front and rear slides mounted on crossed ways, *permitting radial or lateral movements, or combined to produce tapers or irregular forms.* This allows the use of single point tools in many cases in place of form tools with their inherent side thrust. All tool slides actuated by camming systems having adjustable ratios. (The two upper slides are radial only). Machine throughout is engineered to take American-made tools!

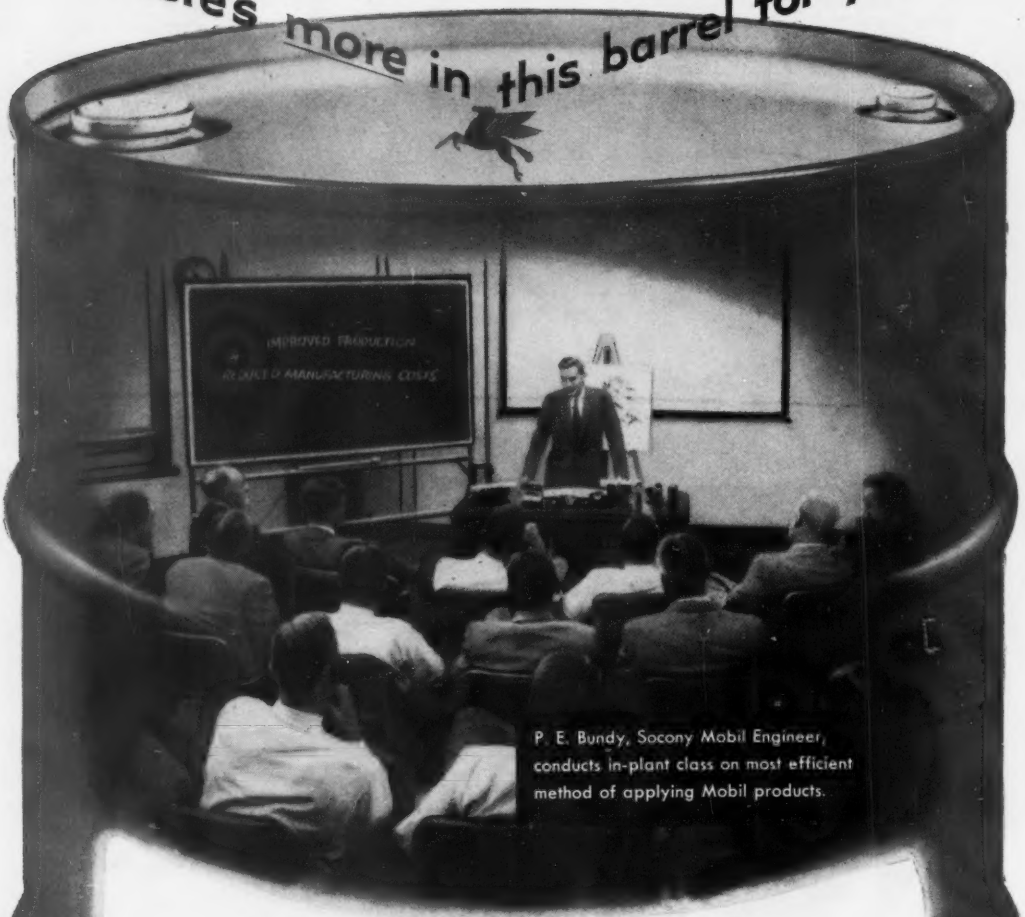


COMPLETE TOOLING and SERVICE in AMERICA.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

There's more in this barrel for you...



P. E. Bundy, Socony Mobil Engineer, conducts in-plant class on most efficient method of applying Mobil products.

MORE IN-PLANT TRAINING

to help you improve production and cut costs!

With Socony Mobil petroleum products we offer you more in-plant training courses and seminars than any other oil company. Lubrication experts instruct your personnel in the most efficient, most economical methods of applying and using our products. This thorough training eliminates over-use and waste—helps improve your production and lower your unit costs.

Socony Mobil products are also backed by *more* field engineers serving industry . . . *more* continuous research to assure continually improved products . . . *more* services for analyzing petroleum products in use . . . *more* approvals from machine builders . . . *more* practical experience—90 years!

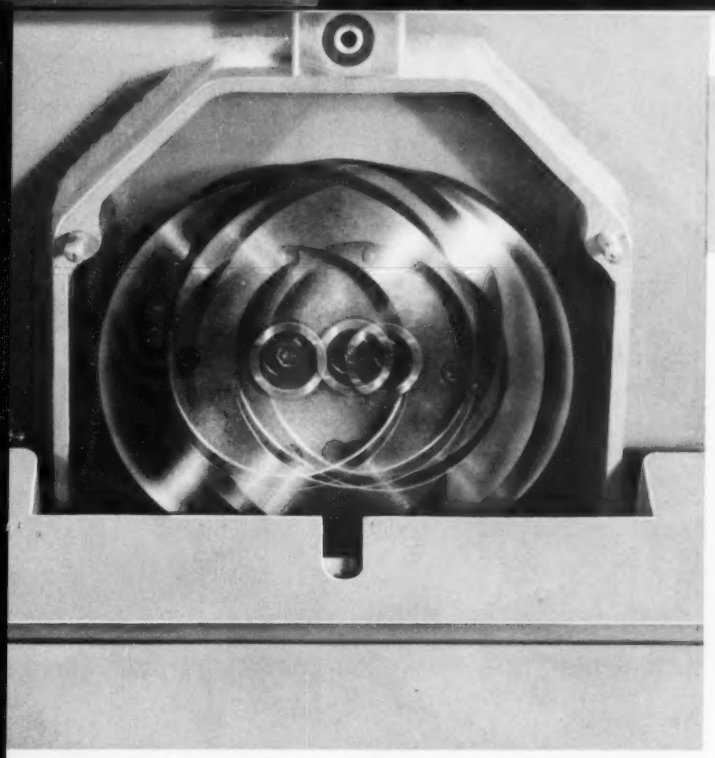
Always specify Socony Mobil. There's *more* in every barrel for you!

SPECIFY **SOCONY MOBIL** FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY
GENERAL PETROLEUM CORPORATION

LUBRICANTS · FUELS · CUTTING FLUIDS · WAXES · SOLVENTS · PLASTICIZERS · PETROCHEMICALS

For more information fill in page number on Inquiry Card, on page 229



Multiple exposure shows the Wesson "TruArc" grinding wheel oscillation which takes skill out of grinding, produces micro-finishes, speeds tool grinding, eliminates wheel dressing. Stroke is adjustable.

Fast WESSON Poweramic grinder requires minimum operator skill

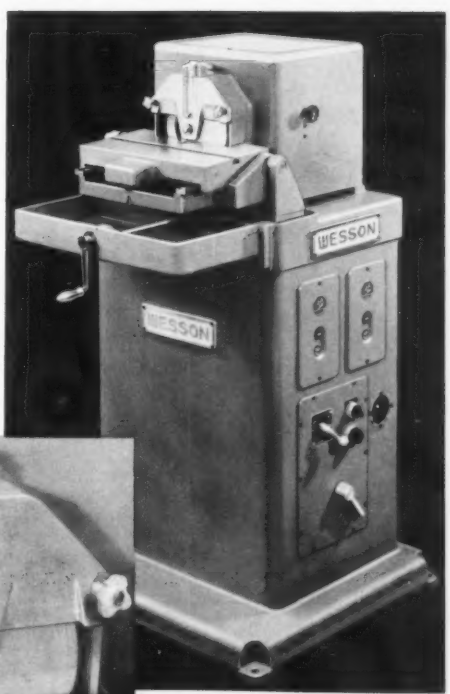
Carbide Grinding Made Easy

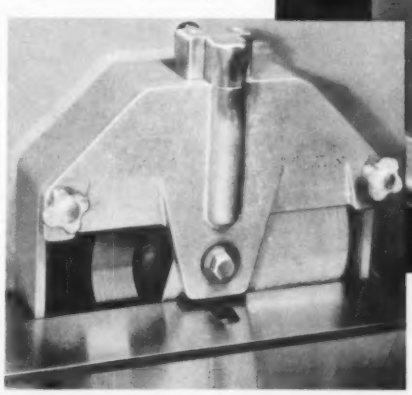
Grinding of carbides to hone-like micro-finishes is now reduced to merely placing the tool on the work table and lightly rolling the table into grinding position. That's all.

The Poweramic principle of true-arc wheel oscillation takes the work and skill out of grinding, and produces finer finishes at speeds far faster than any conventional off-hand grinder available in industry today. Further, this principle also keeps the wheel face dressed automatically.

Here are some other features: work table mounted on multiple concealed ball bearings, double-center-guided with two more ball bearings; work table mounted on trunnion with crank-adjusted table angle from 7° above to 20° below horizontal, as shown, on external permanent protractor; work table weight positively counter-balanced for all angular positions; bag-filtered coolant with adjustable flow from wheel center out across face; full splash protection by unique flip-over splash guard; safety stop for maximum protection against accidental gouging of wheel.

For full details on the Wesson Poweramic ask for Bulletin 56-A.





Four rows of ball bearings support and guide the work table. Angle is set with crank shown.

Unique flip-over splash guard (inset) permits both LH and RH grinding; lets operator see without getting wet.

carbide NEWS

"A New Dimension In Milling . . . . .

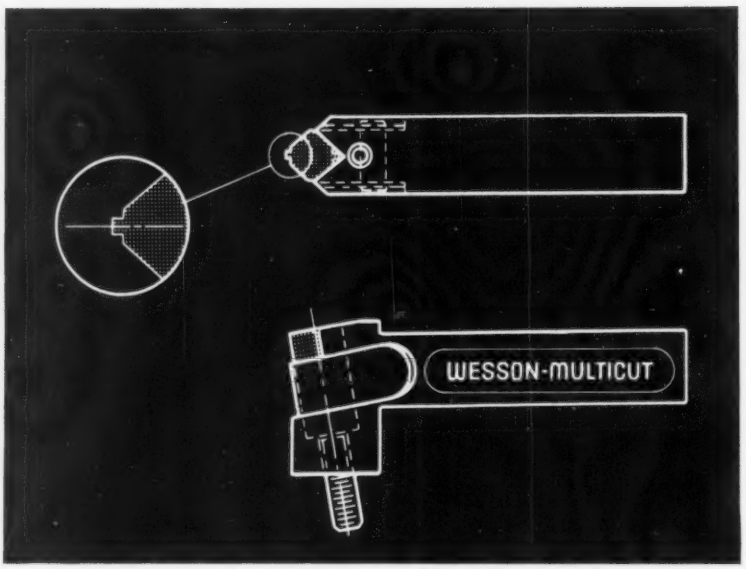
. . . Cutter Design" is the title of a 6 page bulletin describing the new concept of using "throw-away" carbide blanks in milling cutters rather than regrindable inserts. With blade cost reduced to as little as 17 cents per cutting edge, the bulletin tells of the economies possible in many milling jobs. Included in the concept is a new milling cutter design which permits high speed milling at high feeds, quick set-up; re-setting of blades right at the machine; inventory reduction; etc. Ask for Bulletin 556-B.

Wessonmetal Tooled Crank Lathes Show Tool Life Increase Of 29,900%!

Phenomenal gains in tool life despite almost quadrupled output are reported on Wessonmetal tooled Wickes and Le Blond crankshaft lathes, machining cast crankshafts. Output per tool grind has jumped from 30 cranks to 9,000. Production jumped from 11 to 40 cranks per hour. Wesson Multicut band-type tool holders were used. Tool cost dropped $1 per crank in one case, could reach total of several million dollars per year in that company, alone.

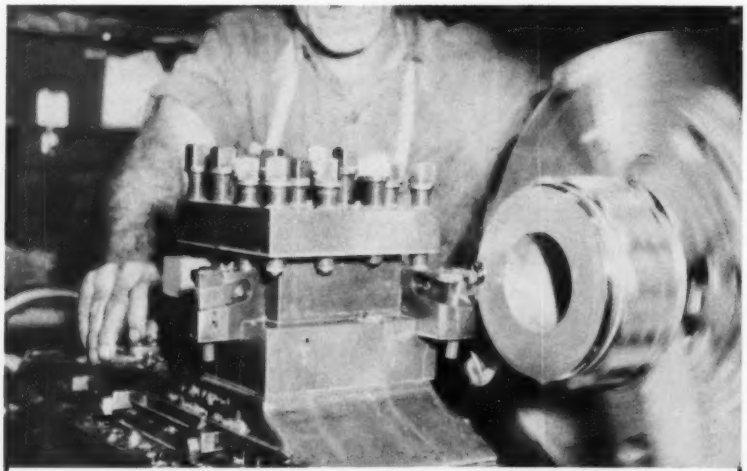
tools Wesson carbide Wessonmetal
WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA: WESSON CUTTING TOOLS, LTD.
93 LEICESTER AVE., TORONTO 18, ONTARIO

Shaft Grooving Costs Cut with New Multicut Tooling



A new line of tools designed specifically for shallow grooving cuts has received such immediate acceptance in industry that it has been adopted practically as a standard for the machining of shallow grooves in automotive transmission shafts, for example.

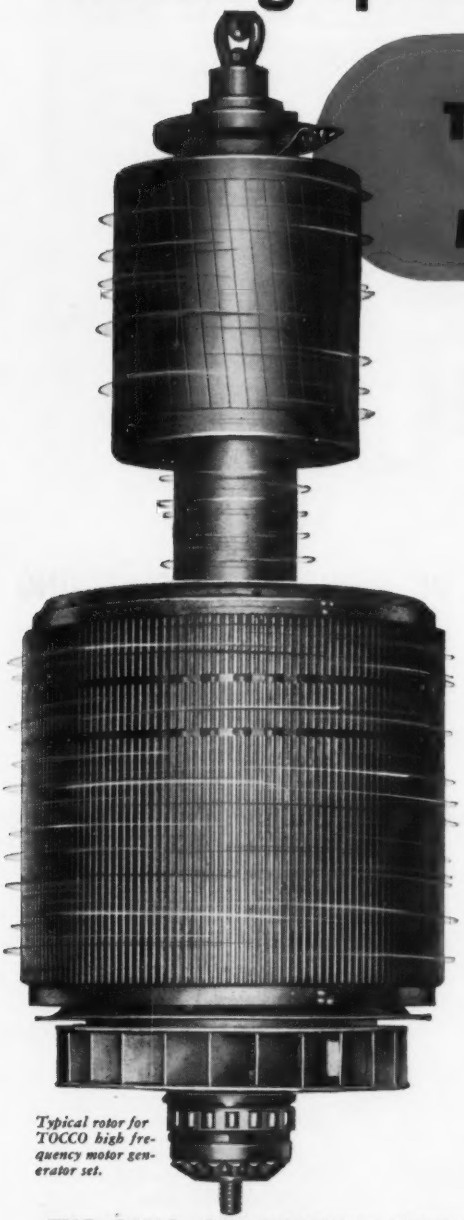
Part of the expanding Wesson Multicut band-type insert holder line, the new tools have 4 "cutting edges" per grind—two at each end. Pieces per grind are way up over conventional tools; set-up and tool change down time is reduced to only a few minutes even for multiple tool set-ups. All replaceable parts except band and insert are standard. For complete data ask for Bulletin #DS-55-2. Insert dimensions are according to customers' needs.



All but 7/100 of one cent of a former tool cost of $7.98 per piece was eliminated on this tough job through the use of Wessonmetal WS in band-type Multicut holders. The operation—turning and facing a crane gear blank—was formerly done with a combination of steel and carbide (not Wesson) tools. Savings on just the first 4 pieces paid for the complete re-tooling.

"Nothing Spins Like a Top"... *except*

TOCCO'S VERTICAL Hi-Frequency Motor-Generator Sets



Typical rotor for TOCCO high frequency motor generator set.

First with Vertical MG Sets—TOCCO

In 1943 TOCCO designed and built the first vertical motor-generator sets for furnishing hi-frequency power for induction heating applications. Now with thirteen years of continuous production experience, we are far and away the world's largest supplier of these units.

Advantages of TOCCO Vertical MG Sets

The large TOCCO vertical type motor generator set has numerous advantages over conventional horizontal type sets. Vertical construction permits the use of very large bearings and also minimizes the hazard of major damage to the set in the unlikely event of a bearing failure. Longer bearing life is achieved due to lower pressure and uniform loading of the bearings. Maintenance is greatly simplified because the rotor can be removed vertically with a simple hoist. Anti-vibration mountings between the base and the MG rotor-stator assembly practically eliminate vibration. No special foundations are needed. Lastly, TOCCO's vertical design cuts necessary floor space to less than one-half the area required by horizontal motor-generator sets.

TOCCO Vertical MG sets are available in sizes up to 350 KW and frequencies from 1000 to 10,000 c.p.s.

Only Time-Tested Vertical MG Sets—TOCCO

There are over a thousand TOCCO vertical MG sets in actual service TODAY—more than all competitive horizontal makes combined. Write us for descriptive bulletin giving full details on the advantages and construction details of TOCCO Vertical MG Sets.

THE OHIO CRANKSHAFT COMPANY

TOCCO

*Trade Mark Reg. U. S. Pat. Off.

Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-6, Cleveland 5, Ohio

Please send copy of "TOCCO High Frequency Motor-Generator Sets."

Name_____

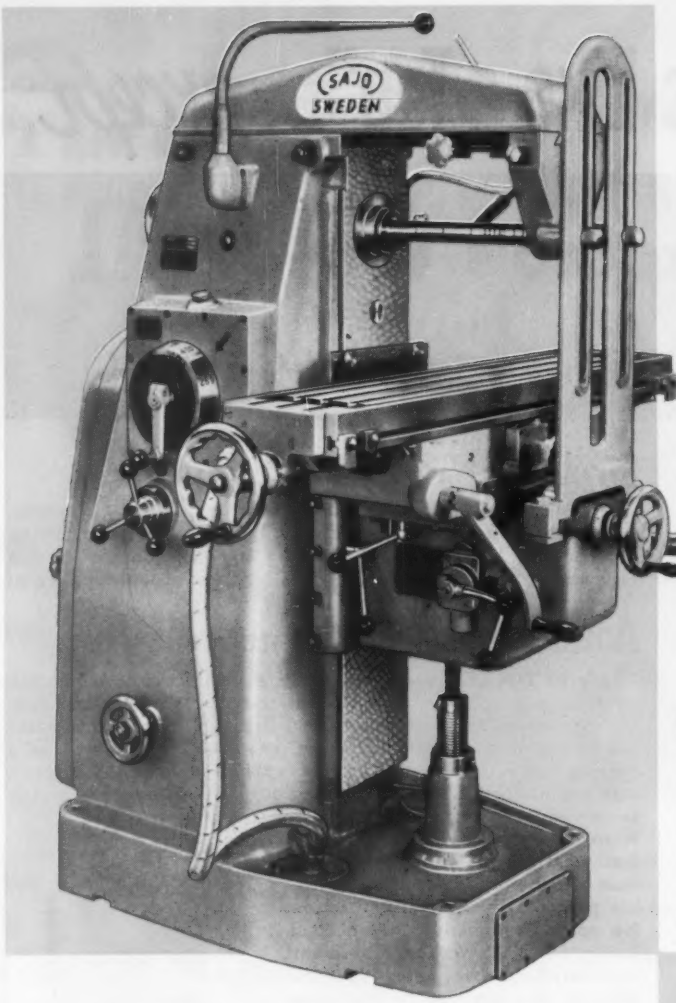
Position_____

Company_____

Address_____

City_____ Zone____ State____

For more information fill in page number on Inquiry Card, on page 229



DET FINNS INGEN ERSÄTTNING FÖR KVALITET

[THERE IS NO SUBSTITUTE FOR QUALITY]

• SAJO MILLING MACHINE MODEL #53

Sajo builds for accuracy to tenths and dependability that assures profitable production. Built to U.S. Standards, initial cost and maintenance are considerably less than comparable first quality millers.

Sajo light duty #2 Milling Machines are available in 2 models both as Plain and Universal types. Plain miller prices are:

Model 53 (illustrated) All Geared	$5,365
Model 49 Back Geared, with enclosed belt drive	$4,110

Both built to same standard of accuracy.
Example: Spindle run-out at end of 12" mandrel = .0008".

POWER

3½ HP

RANGE

Model 53 — 16 spindle speeds 39 to 1500 RPM

Model 49 — 12 Spindle speeds 36 to 1540 RPM

#40 NMT spindle, 12 table feeds.
Table travel: Long, (Universal) 27½", (Plain) 24"; Cross 8¼"; Vertical 18".

CONTROLS

Model 53 — single adjustable Start-Stop-Brake lever. Dial selection of speeds and feeds with single lever control.

Model 49 — push button control.

Both models with magnetic motor starters, feed screws and dials to U.S. Standards.

FOR INFORMATION, CATALOGS, AND REFERENCE DATA, WRITE

austin INDUSTRIAL CORPORATION

76-E MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

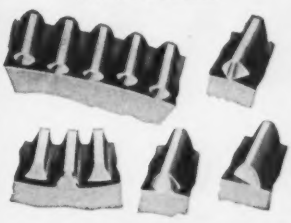
DEALERS IN PRINCIPAL CITIES • LOOK FOR THE AUSTIN SEAL . . . YOUR FULL GUARANTEE OF SATISFACTION

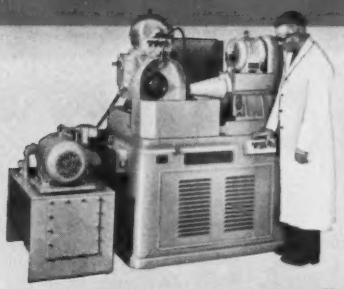
For more information fill in page number on Inquiry Card, on page 229

CHAMFER or DEBURR GEARS and SPLINES the *Low Cost* SHEFFIELD WAY

The ends of gear teeth or splines of all kinds are deburred, chamfered, recessed or precision formed to your requirements at high production rates by these Sheffield machines.

Tooth Forms

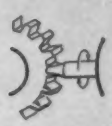


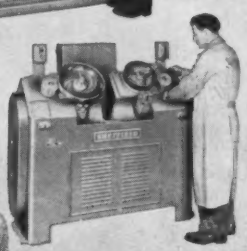


340 Series Machines Chamfer or Deburr:

120 Gear Teeth per Minute **using a Hollow Mill**

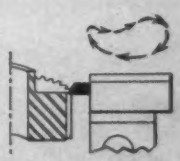
60 Gear Teeth per Minute **using a Pencil Cutter**





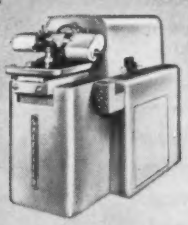
380 Series Machines Deburr:

250 Gear or Spline Teeth per Minute **using a Reciprocating Chipper Tool**



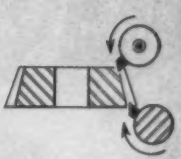
370 Series Machines Deburr:

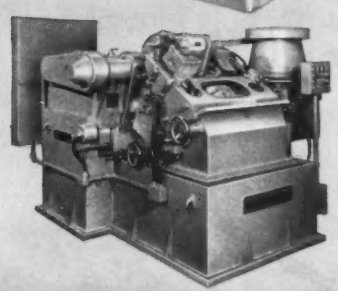
250 Spline Teeth per Minute **using a Flytool**



350 Series Machines Deburr:

300 Spiral Bevel or Hypoid Teeth per Minute, **both sides simultaneously using Two Flytools**





Gear Deburr Grinder removes burrs from 1200 Spur or Helical Gears per Hour

7233

For descriptive literature on this equipment write to Div. 810, The SHEFFIELD CORPORATION, Dayton 1, Ohio, U.S.A.

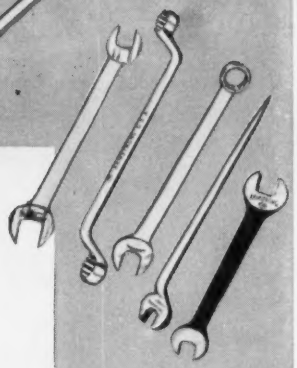
GOLDEN ANNIVERSARY — MASTER CRAFTSMAN HEADQUARTERS

SHEFFIELD

manufacturing and management for machine

ARMSTRONG

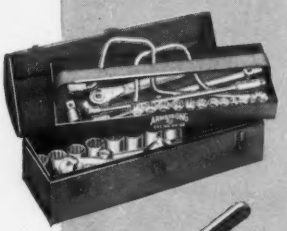
Quality TOOLS

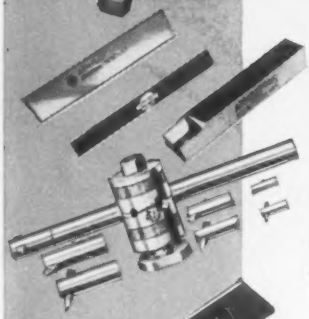


More than meets the eye

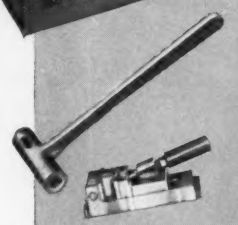
There are extra values in ARMSTRONG TOOLS that become apparent only with use.

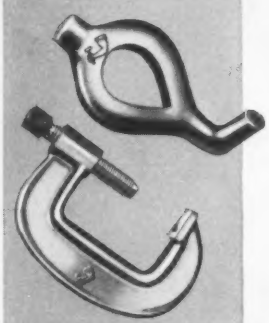
TOOL SENSE— convenience in use — the most efficient *"tool approach"* built into ARMSTRONG Tool Holders; the balance and *"feel"* of an ARMSTRONG Wrench; the *rigidity* of ARMSTRONG "C" Clamps; the extra *toughness* of ARMSTRONG Lathe Dogs and Eye Bolts; the universal *adaptability* of ARMSTRONG Set-up and Hold-down Tools — the evidence of "tool sense", the understanding of each tool's requirements.



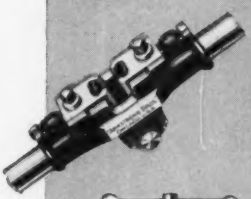


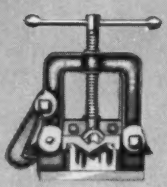
STRENGTH — built into each individual ARMSTRONG TOOL is a safety factor of extra *strength* — *strength* beyond any need, the inherent strength of specially selected materials enhanced by proper heat treatment and hardening.

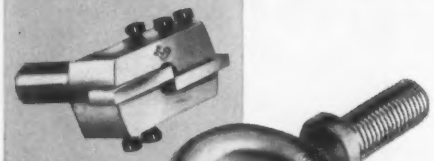


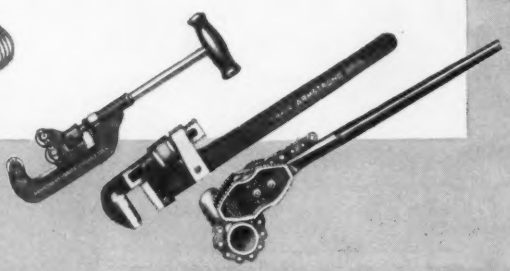


UNIFORM QUALITY — the uniform quality made possible by modern manufacturing methods, in a specially-built plant equipped with every needed quality control. The name ARMSTRONG with the Arm-and-Hammer Trade Mark is universally recognized as a guarantee of finest quality.







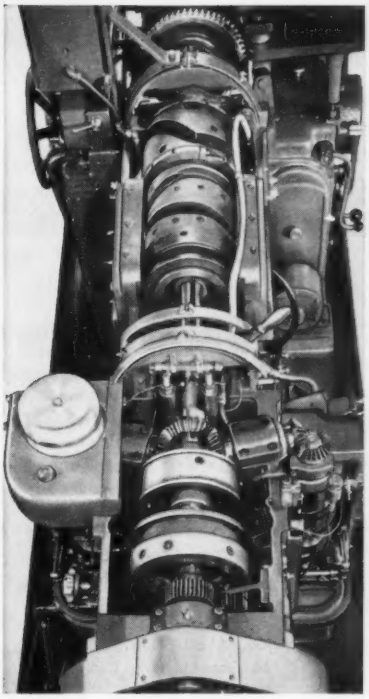


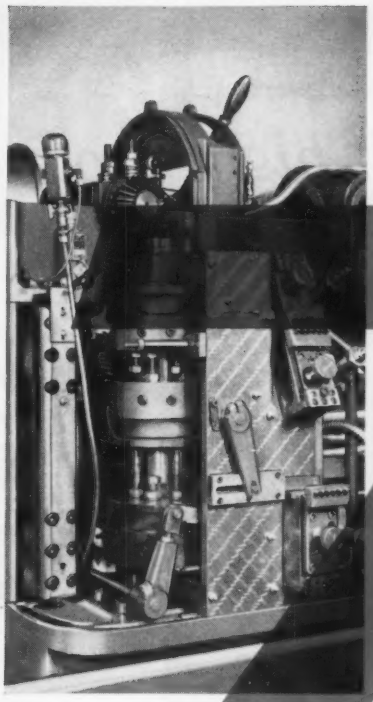
ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5213 WEST ARMSTRONG AVE. • CHICAGO 30, ILLINOIS

For more information fill in page number on Inquiry Card, on page 229



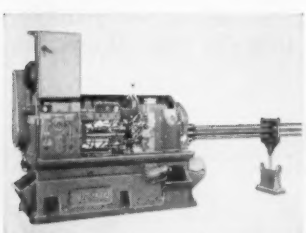


Seven Fast Changeover Models

With the prospects of improved tool materials ever decreasing the actual machining time of work on Multiple Spindle Automatics, long runs tend to become short runs. Facility that decreases the time for job changes becomes more important to low-cost production.

Conomatics are available in as many as seven fast changeover models. These are the 9/16", 1", 1⅝" Sixes, and the 2⅝", 3½", 5", and 5¼" Fours.

These models are equipped with dial adjustment of working stroke of all slides, without making necessary change of total stroke or positive stop settings. Write, wire, or phone for literature descriptive of these features and other facilities available to users, or prospective users.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

the finest high production lathes

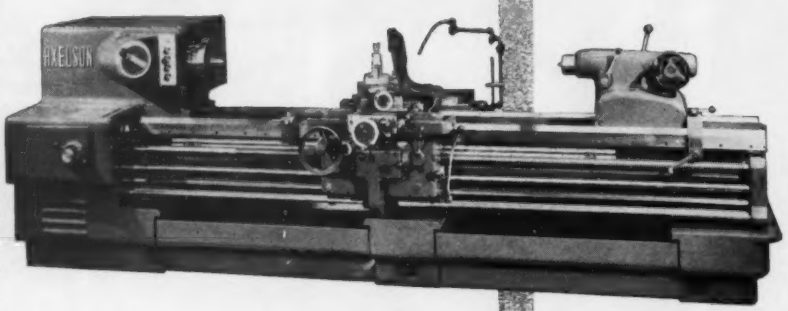
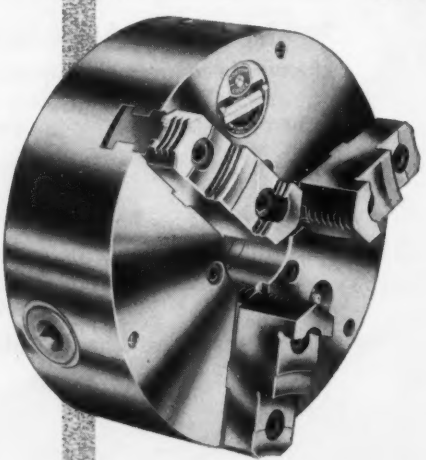


Photo courtesy
Axelson
Manufacturing Co.

Axelson's new 25/16 heavy-duty engine lathe is designed to increase production, reduce turning time and simplify operator control. It features 40 h.p. over 32 spindle speeds, a single lever hydraulic speed selector; 66 feed combinations, exclusive 5-position diameter cross-feed disconnect stop and 7-position longitudinal power-feed disconnect stop. For more information, write Axelson Manufacturing Co., 6160 South Boyle Ave., Los Angeles 58, California.

deserve the finest high production chucks

This is Horton's standard 3-Jaw Scroll Universal Chuck which has contributed to Horton's reputation for chuck leadership for over 100 years. Its precision and lasting accuracy make it a must in any production picture. For the complete story on the complete line of Horton Chucks, see the Horton people in your area now.



HORTON
Since 1851
CHUCK

WINDSOR LOCKS, CONN.

AXELSON production and maintenance news

AXELSON MANUFACTURING COMPANY / DIVISION OF U. S. INDUSTRIES, INC. 6160 SOUTH BOYLE AVENUE, LOS ANGELES 58, CALIFORNIA

New 32" lathe features 81 standard feeds...simple selection of 45 different threads

To provide users with utmost flexibility in machining, the new Axelson 32" heavy-duty lathe has 81 feeds ranging from .005" to .351" per revolution of the spindle. Forty-five threads, from 1 to 30 per inch, are possible with the standard gear box.

By simple substitution of gears in the end train, odd threads or leads and ranges of metric module and diametrical pitches can be obtained. Two levers control the selection of feeds and leads. One lever divides the feed range into four groups. The second lever selects the feed or lead desired.

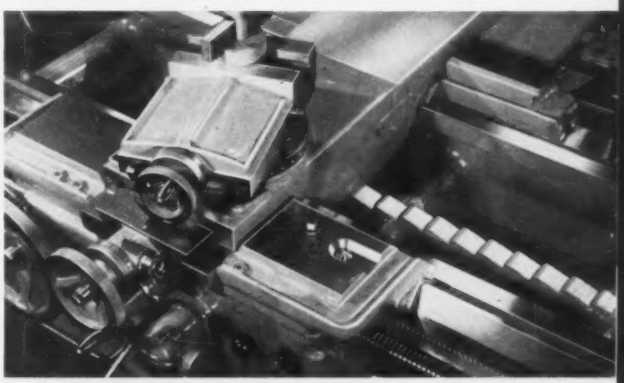
CONVENIENT CARRIAGE CONTROLS. All controls for operating the carriage are located on the apron convenient to the operator. Controls for both cross and longitudinal feeds are through easily operated drop levers which actuate serrated clutches to insure smooth operation and maximum power transmission. Longitudinal rapid traverse in either direction is controlled from the left side of the apron. Headstock control, to start, stop and reverse the spindle, is located on the right side of the apron.

RIGID, TWO-SPEED TAILSTOCK. The two-speed tailstock provides a fast rate of movement where it is desirable to bring the tailstock center up to the work-piece as rapidly as possible; or a slow powerful movement of the spindle for feeding drills, reamers and other tools held in centers.

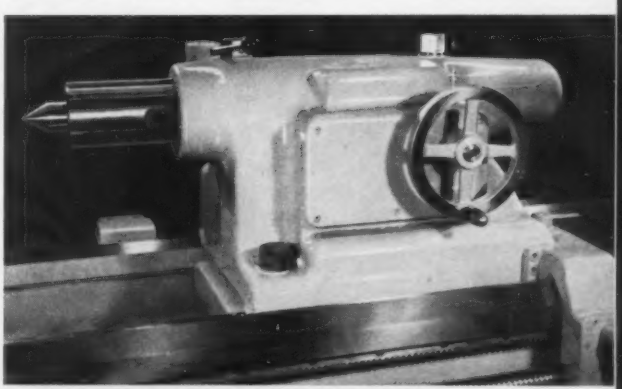
The new Axelson 32" lathe has many other outstanding features. For more information on it, the new 25/16 and other Axelson tool room, heavy-duty, sliding bed and hollow spindle lathes, write for catalogs M6-5507 and 5504.

AXELSON Manufacturing Company
Division of U. S. Industries, Inc.

TOTALLY ENCLOSED GEAR BOX. All gears run in continuous oil bath. Gears and shafts are mounted on anti-friction bearings for smooth, quiet operation.



VIBRATION-FREE CARRIAGE. Carriage locates on hardened steel front-way and rides on wide, flat hardened steel rear-way. Result is rigid, vibrationless turning on even heaviest jobs.



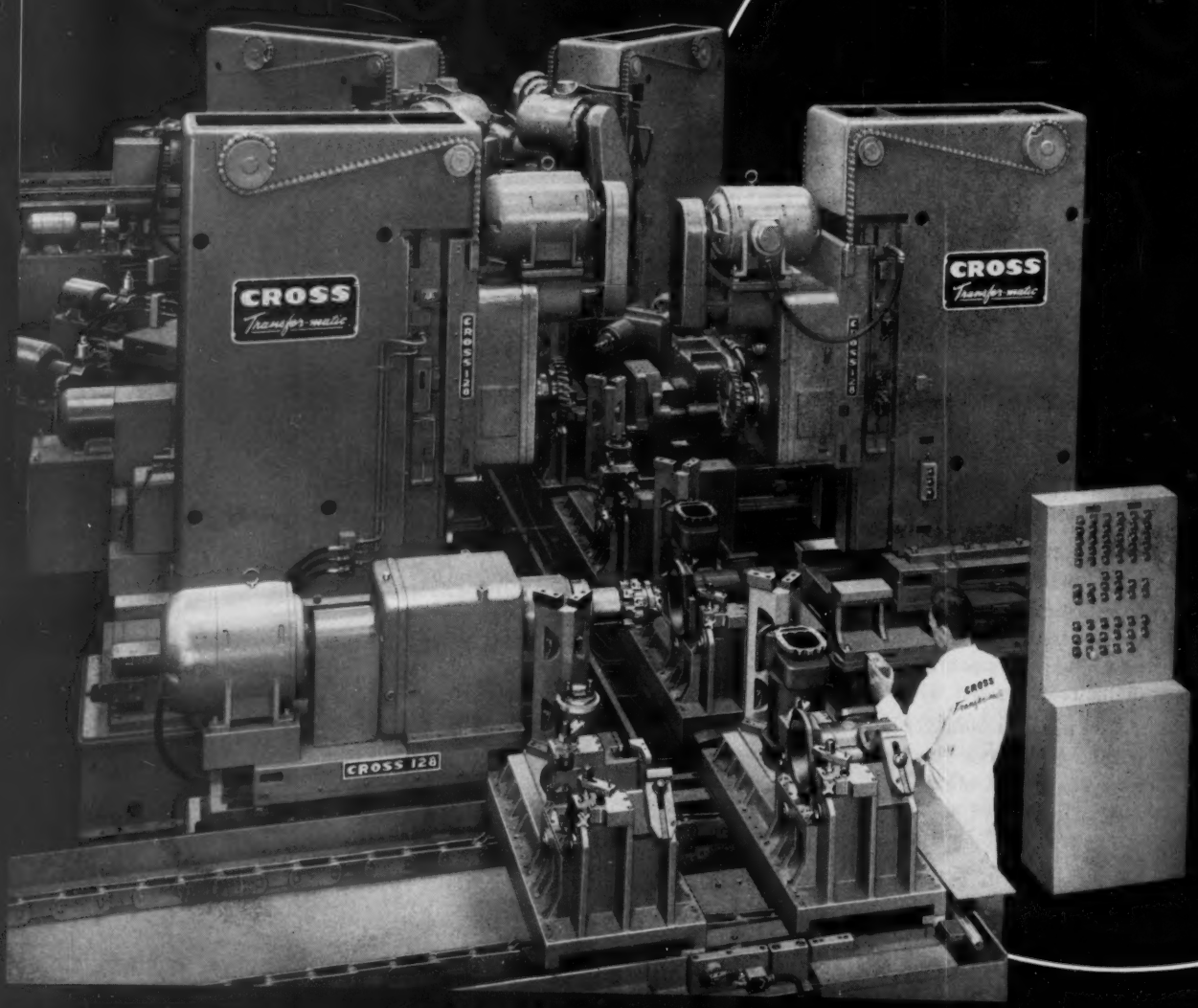
ONE-PIECE TAILSTOCK. Tailstock is rugged, one-piece design which transmits extreme tool loads to bed. Tailstock can be clamped to bed for extremely heavy jobs.

For more information fill in page number on Inquiry Card, on page 229

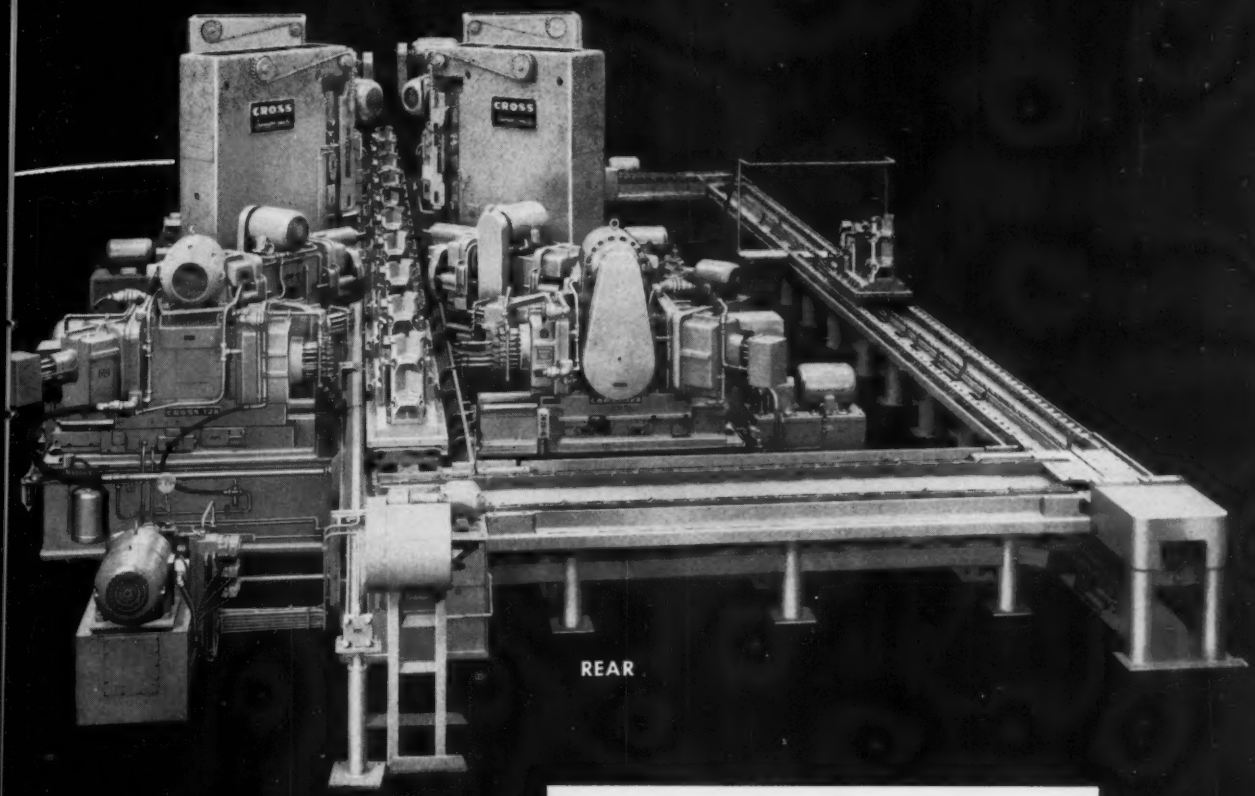
Completely Machines Air Conditioning Housings

(from Rough Castings to Assembly)

Another Transfer-matic by Cross



OPERATOR'S STATION



REAR

- ★ 18 pieces per hour at 100% efficiency.
- ★ 159 operations: 6 milling, 6 boring, 1 facing, 81 drilling and 65 tapping.
- ★ Two-position, progressive type, palletized work holding fixtures for carrying the parts from station to station.
- ★ Modular unit construction provides flexibility for part design changes.
- ★ All parts in Cross machines—even tooling details—are made to interchangeable tolerances for fast, easy maintenance.
- ★ Other features: Construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and boring; individual lead screw feed for tapping; automatic lubrication; automatic chip conveyor.

Established 1898

THE CROSS CO.

First in Automation

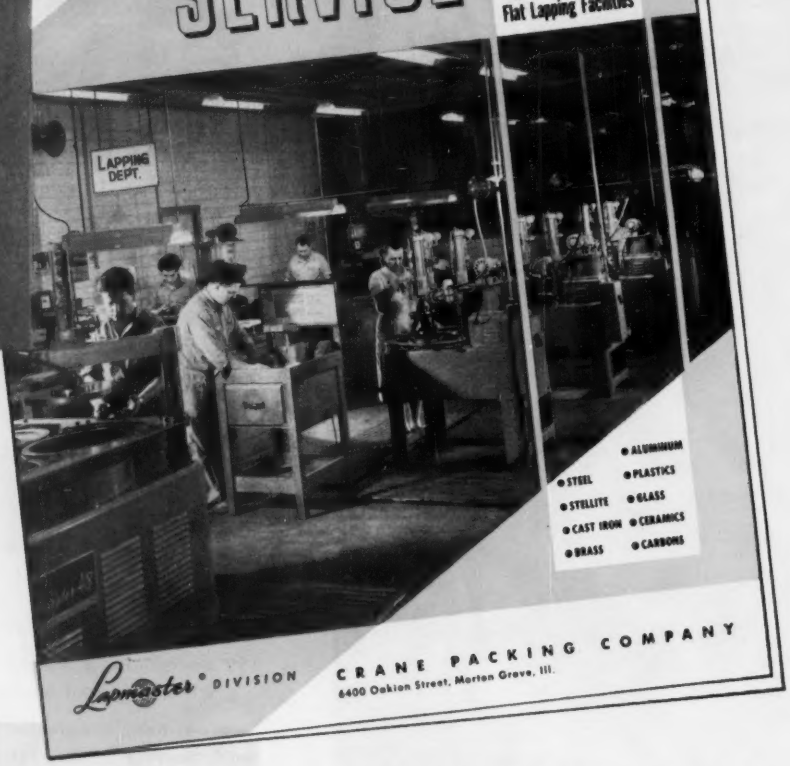
DETROIT 7, MICHIGAN

Need parts finished to precision flatness?

Crane Packing Company

FLAT LAPPING SERVICE

NEW High Production Flat Lapping Facilities



Lapmaster® DIVISION CRANE PACKING COMPANY
6400 Oakton Street, Morton Grove, Ill.

Read this folder

If you're looking for someone to produce precision flatness on your parts, our flat lapping service department is equipped to produce parts with a flatness of .000011 inch or less and finishes to 2 micro inches on a wide range of sizes in large or small production runs. Materials range from steel, Stellite, cast iron, brass and aluminum to plastics, glass, ceramics, carbons and many others.

Thirty-six machines, together with "know how" and precision inspection facilities, insure work to meet your requirements. Branch service plants are also located in Houston, Los Angeles, Miami, New York, Philadelphia and Hamilton, Ontario.

For complete information, write for this free folder today.

CRANE PACKING CO.
6433 Oakton St., Morton Grove, Ill. (Chicago Suburb)

In Canada: Crane Packing Co., Ltd., Hamilton, Ont.

Lapmaster is protected by United States and Foreign Patents

Lapmaster® DIVISION

CRANE PACKING COMPANY

38 YEARS INDUSTRIAL PROGRESS

For more information fill in page number on Inquiry Card, on page 229

LET HARD • LONG WEARING • FASTER CUTTING

Tungsten Carbide

DO YOUR DRILLING TOO!

STC

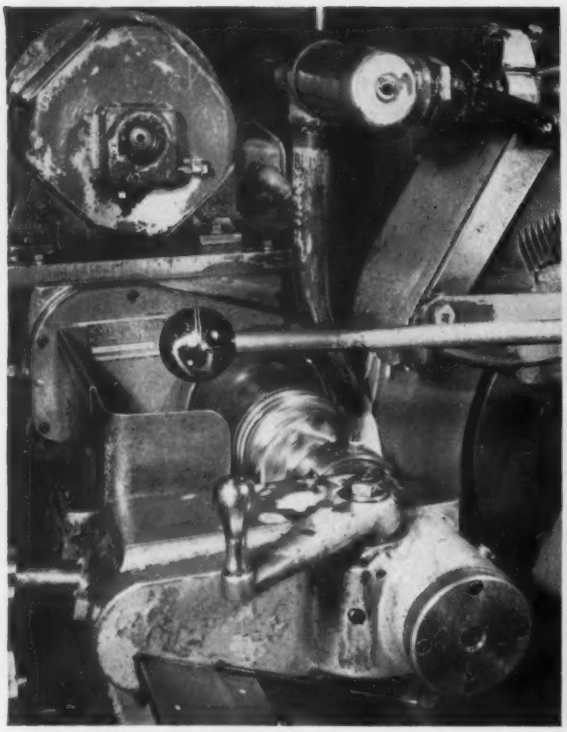
QUALITY CARBIDE TOOLS

Super

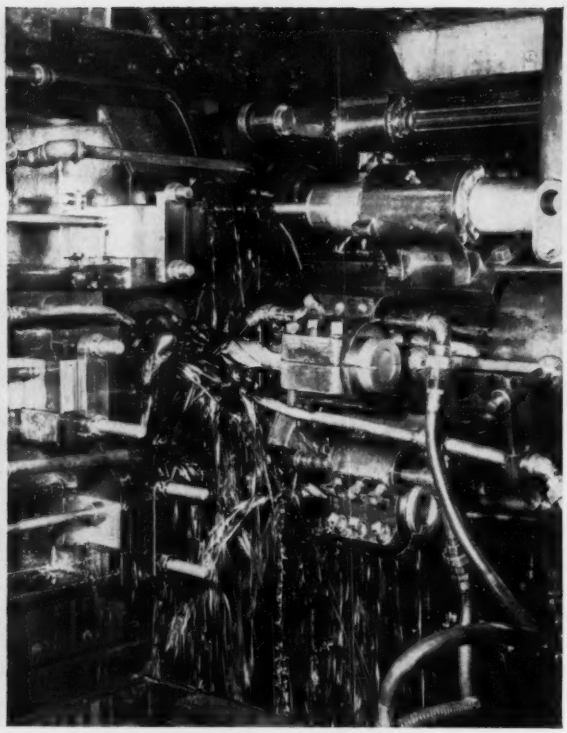
TOOL COMPANY

21650 Hoover Rd., Detroit 13, Michigan • 5210 San Fernando Rd., Glendale 3, California

DEPT. 362 ● SUBSIDIARY OF VAN NORMAN INDUSTRIES, INC.



Grinding with Texaco Soluble Oil HW



Automatic machining with Texaco Sultex Cutting Oil

"We found out fast that Texaco does an excellent job"

Jack & Heintz, Inc., Cleveland, Ohio

"About a year ago," reports Jack & Heintz, Inc., "we tested competitive cutting fluids against the Texaco products we had been using for a number of years. We found out fast that Texaco does an excellent job.

"To cite just two examples: On our grinding operations, where precision is essential and low micro finishes necessary, we found that *Texaco Soluble Oil HW* (especially designed for hard water) gave us good rust protection and a fine finish at lean emulsion ratios. In addition, it did not load wheels and we had no odor complaints.

"In our automatic department, where we have all types of single- and multi-spindle machines and work all types of material including high alloy and stainless steels, *Texaco Sultex Cutting Oil B* gave us the good finish, long tool life and uninterrupted performance we wanted."

There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to help you do all your machining better, faster and at lower cost. Texaco Lubrication Engineering Service will gladly help you select the proper ones. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

TUNE IN . . . TEXACO STAR THEATER starring JIMMY DURANTE on television . . . Saturday nights, NBC.

For more information fill in page number on Inquiry Card, on page 229

- **Operation transition**
- **The Navy's machine tools**
- **The H-bomb and your plant**
- **Lower income taxes coming?**

Keeping up with Washington

By Loring F. Overman

WHAT strange things Washington has in store for machinery industries! They're hinted at in a statement by Admiral Arleigh A. Burke, Chief of Naval Operations. Forecasting a period of dramatic transition, Admiral Burke explained, "We are going from props to jets, from oil burners to nuclear reactors, from subsonic to supersonic, from TNT to nuclear war heads, from conventional shells to missiles, from the atmosphere to space. We are living in an exciting period."

The new role of machinery has not yet been established, but in guarded laboratories and at isolated firing sites, prototypes of tomorrow's weapons and machines are gradually coming out from under wraps. Typical of the new weapons is the 1400 mile-per-hour F-104A Starfighter of the Air Force. Fifty-five feet long . . . wings, 7 1/2 feet from tip to fuselage . . . weight, half that of comparable fighters. Employed, obviously, are new metals, new techniques, new aerodynamics . . . and next, new machines to produce these airplanes in quantities.

Rocket industries are maturing rapidly. Attaining projected rocket speeds of 5000 to 6000 miles per hour calls for new concepts of heat, thrust, and strains, and again, new raw materials and new methods of using them. Approximately 16,000 persons are already employed in the nation's rocket plants, with some of the biggest corporate names in the aviation and automotive industries participating.

Possibly less dramatic, but no less prophetic, is a recent announcement by General Motors of successful tests of a free-piston automobile engine. Another car manufacturer, Chrysler, is installing Diesel engines in some of its export passenger cars. At every turn, transition . . . and new assignments for machines!

Navy Tool Replacement Program

To keep its machine tool inventory up to date, the Navy's Bureau of Aeronautics will require $6,000,000 annually over the next decade at least, possibly indefinitely. So the House Appropriations Subcommittee was told by Rear Admiral James S. Russell, chief of the Bureau. The admiral claimed that the program is part of a continuing operation to modernize the $60,000,000 World War II machine tool inventory of the Bureau.

No new funds for machine tools are being requested in fiscal 1957 by the Bureau of Ships. However, a fund of $2,400,000 (from a $100,000,000 appropriation for Defense Department purchases of long-lead-time tools) is available. Expenditure of $500,000 is anticipated in 1956; $1,300,000 in 1957; and $500,000 in 1958.

H-Bomb Damage

If an H-bomb were dropped near your plant, what plans have you made to continue operation? Washington expects to find out in the period of July 20 to 26, when three government agencies will stage Operation Alert. This, the third of a series of annual exercises designed to test civil defenses, will be conducted by the Office of Defense Mobilization, the Defense Department, and the Federal Civil Defense Administration. In addition to the problems of evacuation and care of the injured, this program is intended to include an assessment of damage, a determination of remaining resources and survival requirements and allocation of these resources.

Upon analysis of detailed information from thousands of manufacturing plants, sponsors of Operation Alert expect to be able to determine who and what would be left in seventy-six bombed-out areas of the United States. What they find out might produce another Operation Transition, or perhaps an Operation Migration for defense-connected industries.

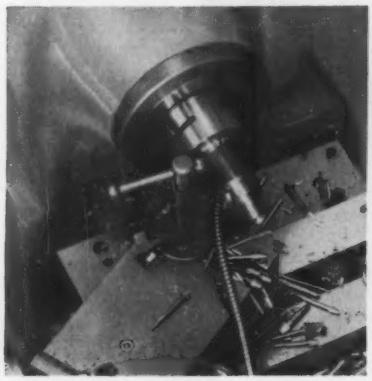
Tax Outlook

First-quarter production of goods and services was at an annual rate of $339,000,000,000. Tax analysts predict that if this level of business continues, there will be a $4,000,000,000 tax surplus which could be distributed as a voter's bonus, in the form of a cut in income taxes. The administration, still holding out for a balanced budget, indicates it wants to see the money in the bank before making any tax-cutting commitments. And possibly anticipating these increased revenues, the fiscal 1957 budget requests an additional $1,600,000,000—up to a total appropriation of $65,900,000 for the year.

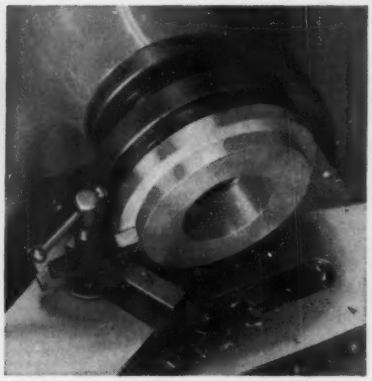
Two national business organizations are urging voters to support their efforts to seek tax reductions. The National Association of Manufacturers proposes cuts in personal and corporate income taxes, over a five-year period, to reduce surtax rates by 80 per cent. The Chamber of Commerce, while favoring the NAM cuts, also believes that $5,500,000,000 could be pared from federal expenditures by more careful planning. The Chamber wants voters to ask legislators to approve the 314 recommendations of the Hoover Commission.

HARDINGE
ELMIRA, N.Y.

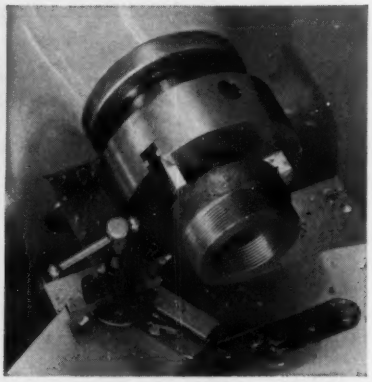
"The Outstanding Tool Room Lathe"



Precision Collet work for all sizes to 1-1/16" Collet seats *directly* in spindle.



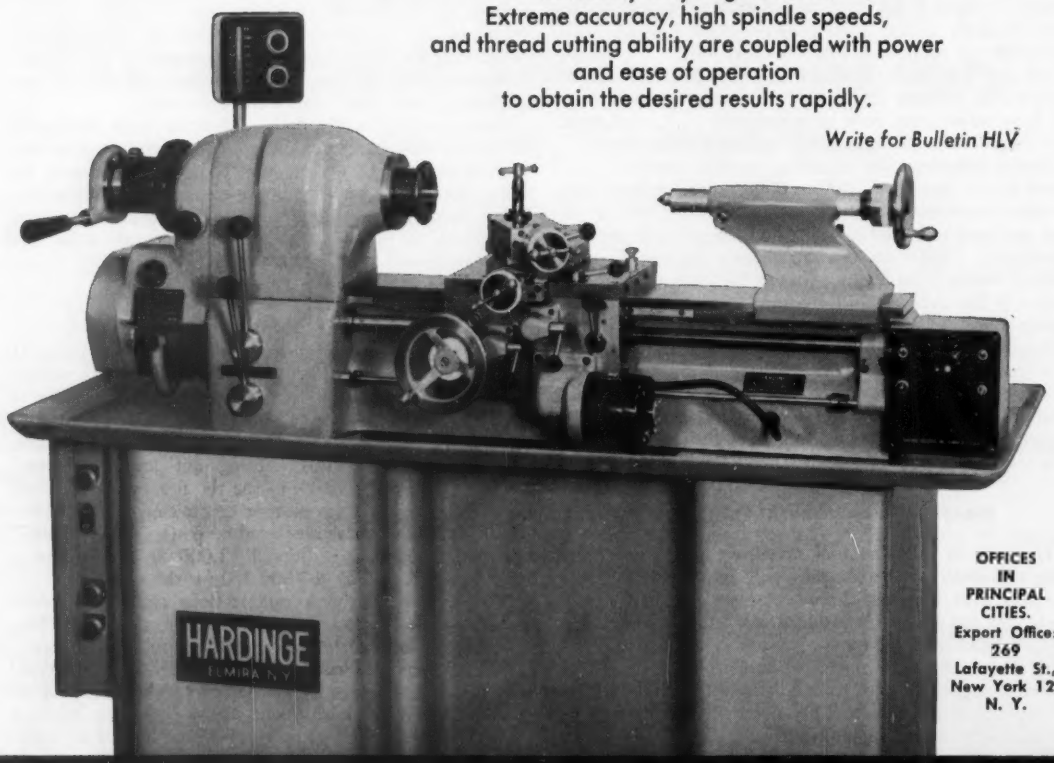
Precision Step Chucks for diameters up to 6". Provides Collet-like accuracy.



Integral Mount Jaw Chucks for precision holding of regular or irregular shapes up to 5".

Hardinge Model HLV 10" Lathe was primarily designed to fill a very old existent gap between the plain precision bench lathe and the heavy duty engine lathe.
Extreme accuracy, high spindle speeds, and thread cutting ability are coupled with power and ease of operation to obtain the desired results rapidly.

Write for Bulletin HLV



OFFICES IN PRINCIPAL CITIES.
Export Office: 269 Lafayette St., New York 12, N. Y.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

For more information fill in page number on Inquiry Card, on page 229

MACHINERY
JUNE 1956

Engineers' Need of Wider Practical Knowledge

"The old order changeth, yielding place to new." Never was Tennyson's rhyme truer so far as the metal-working industry is concerned than at the present time. With a national economy of 400 billion dollars, large-scale production is becoming increasingly complex. Automation has brought new concepts of mass production that have greatly increased the amount of knowledge demanded by engineers responsible for the design, construction, and operation of automated equipment. Every day brings new materials, equipment, and methods.

Ceramic tools, for example, are pointing the way toward revolutionary changes in metal-cutting practice. Plastic dies are effecting important economies in operations performed on hydraulic presses and other equipment. Ultrasonic and electrical discharge machines for the removal of metal, used today, would have been considered in the realm of fantasy only a few years ago. In a day when intercontinental missiles are on everyone's tongue, who can tell what the problems of engineers may be in the immediate future!

If engineers are to be capable of applying the latest manufacturing ideas, they must possess a greater practical knowledge concerning shop methods than ever before. How can they develop the most efficient production methods for a particular job unless they are familiar with the principles on which new tools and machines function?

The limited machine shop training engineers receive in college provides only fundamental knowledge about standard methods that are applied mostly in the smaller shops. To be prepared for the revolutionary developments that are constantly appearing on the horizon, engineers must obtain practical knowledge far beyond the limited shop instructions imparted to them during school years. They should find a means of upgrading themselves in specialized knowledge and practical capacity, so that they can make themselves ready for larger responsibilities.

How engineers can best obtain a constantly expanding knowledge about shop practices is an important question. The answer lies in adopting a program of systematically reading the editorial and advertising pages in the technical magazines that are directed to their individual fields of endeavor. Nowhere else can they find a continuous flow of information concerning standard and unique practices in their industrial spheres. No other plan will bring as great rewards in the way of increased knowledge that can lead to higher planes of achievement in their work-a-day world.

Charles O. Herb

EDITOR

or solid

a steel tube or bar for every purpose

TUBING: SEAMLESS AND WELDED

Whatever your tubing requirement—whatever kind and quantity you need—you can get quick delivery of a quality product with a single call to Ryerson.

That's because Ryerson stocks are the nation's largest, including more types and sizes, more tonnage, than any other source. And Ryerson service facilities are unequalled, too.

Hack saws, band saws and equipment for production lathe cutting and chamfering assure quick service on your orders. In addition, a staff of tubing specialists puts years of experience to work on your problems of tubing selection and fabrication. So call Ryerson for everything in tubing and tubing service.

In stock: Cold drawn and hot rolled seamless mechanical tubing, hot and cold rolled welded tubing, hydraulic and cylinder tubing, structural tubing, etc.

COLD FINISHED BARS

Careful handling, accurate cutting, vigilant inspection—these are just three of many ways in which Ryerson assures you of the highest quality in cold finished bars.

Stored in temperature-controlled rooms, spark-tested to guard against mixed steels, Ryerson cold finished bar stocks include rounds, squares, hex's, flats—screw steel, accuracy stock, turned, ground and polished shafting, Ledloy for fastest machining—everything you need. And even the hard-to-get intermediate sizes are on hand.

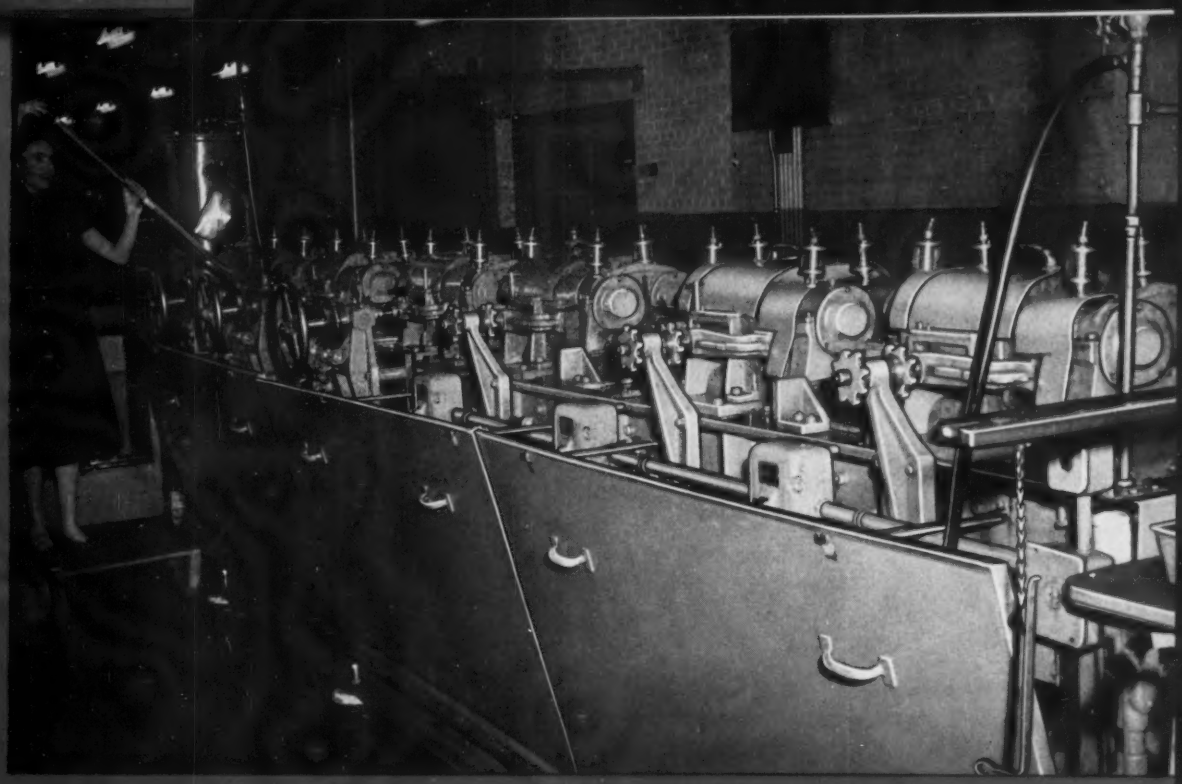
To help you select the best cold finished bar for each application, we have just published a simplified guide showing the comparative strength, cost, machinability, workability, etc. of all commonly used types. Write for your copy and call Ryerson when you need high quality cold finished bars.

RYERSON STEEL

In stock: Bars, structurals, plates, sheets, tubing, alloy and stainless steel, reinforcing bars, machinery & tools, etc.

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CHARLOTTE, N. C. • CINCINNATI • CLEVELAND
DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

For more information fill in page number on Inquiry Card, on page 229



BLADES AND RAZORS FOR THE MORNING SHAVE

By EDGAR ALTHOLZ
Associate Editor

THE distinction of bringing the male population into its first contact of the day with precision belongs—in a literal sense—to the morning shave. Necessary appurtenances to this bathroom ritual of millions of men are a keen blade and a well-balanced safety razor. This article describes some of the highlights in the making of these items at the new plant of the American Safety Razor Corporation near Staunton, Va.

One of the largest companies in the business, seventy-five-year-old ASR produces all three major types of blades—single-edge, double-edge, and injector—as well as safety razors for single-edge and injector blades. Names under which products are marketed include Gem, Ever-Ready, Pal, Silver Star, Personna, and Treet.

Blade steel, made to the company's strict specifications by domestic and Swedish mills, arrives in coil form of finished blade thickness and width. Once the material has been inspected and its analysis checked, it is fed to a row of Henry & Wright 10-ton punch presses. These machines, cycling automatically, perforate and score the strip.

In Fig. 1, a single-edge blade strip can be seen leaving one of the presses. Perforations consist of slots, alternately at right angles, and serve to locate the blade in the razor. At the same time, the slots assist in the manufacturing process.

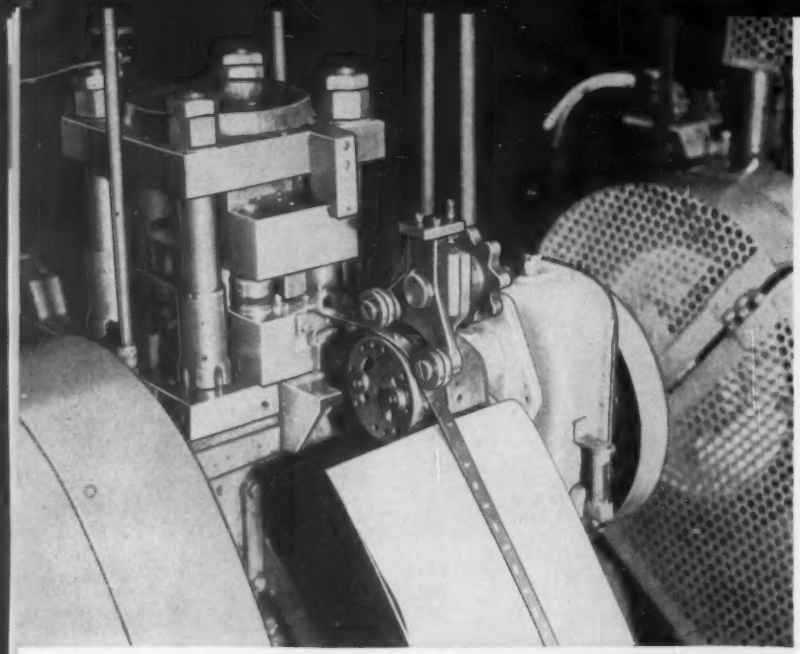


Fig. 1. (Left) The first step in blade production is the perforating of the slots. These are utilized in locating and stacking the blades in some of the subsequent operations.

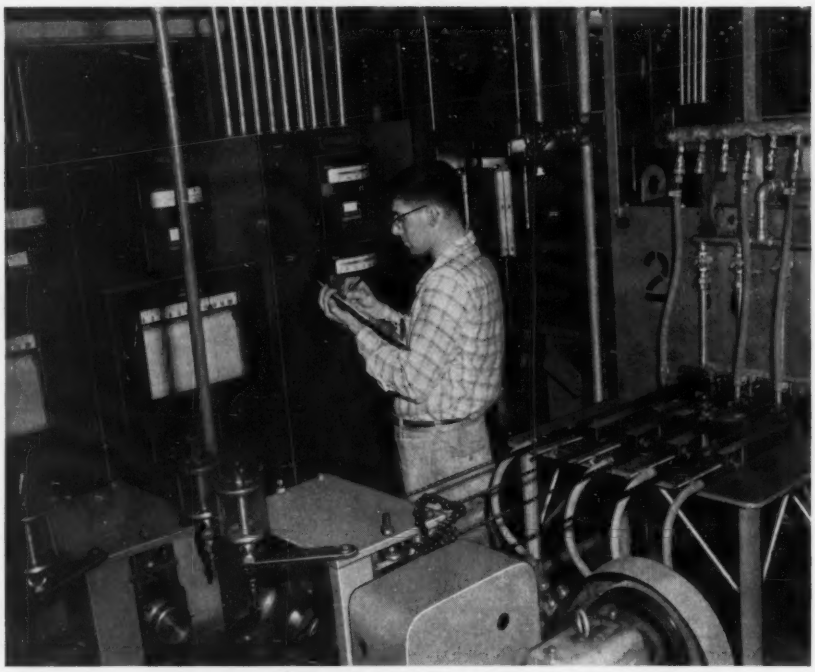


Fig. 2. (Right) Still in strip form, the blades are heat-treated in continuous type furnaces. Four strips are handled simultaneously. Here, they are seen as they leave one of the tempering furnaces.

Here, for example, as the strip leaves the dies, the slots are engaged by pins in the wheel of an indexing feed mechanism by means of which the strip is advanced.

The score, produced in conjunction with the perforating, crosses the center of the alternate slots which are parallel to the strip axis. Later, after final honing, the score provides a breakoff point when the strip is cut up into blade lengths.

Upon leaving the press area, the strip is rewound into coils and conveyed to a fully automatic heat-treating line. There is a battery of furnaces, each capable of handling four strips at a time. At the start of the line, the strip is unwound and passed through a degreasing tank to remove the protective oil film. Rollers squeeze the strip as it emerges from the tank and thus keep it under tension for the trip through the continuous type electric furnaces.

Hardening, in the first furnace, is performed in an endothermic atmosphere (principally hydrogen, nitrogen, and carbon monoxide). This atmosphere is of an analysis that is in equilibrium with the high carbon content of the strip and so prevents any loss of carbon.

A unique quenching means is found at the exit

of the hardening furnace. There, as the strip emerges, it travels between a pair of carbide guides which are backed up by water-cooled steel blocks. A forced circulation of water from the plant's refrigerating system keeps the blocks and guides cool enough to do an efficient job of quenching the strip as it moves along at uninterrupted speed to the adjacent tempering furnace.

In Fig. 2 is a view of the end of one of the tempering furnaces, showing the pinch-roll mechanism which pulls the strip through the heat-treating line. Leaving the rolls, the strip is once more wound into coils. While the coil is being formed, it revolves in a bath of oil which prevents any rust from forming before subsequent processing starts.

Highly specialized transfer lines, developed by the company, finish the blade edge at high speed. One of these lines appears in the heading illustration. Each line contains multiple grinding, honing, and stropping stations. For single-edge blades, each station has two opposing heads, between which the work advances. Double-edge blades go through a line having upper and lower rows of opposing heads.

Ordinarily, the work advances down the line still as a strip, being cut off into blade lengths after leaving the final honing station. In other instances, the strip has already been cut off into blades, and these are fed down a chute onto a circulating tape. The heads at the grinding stations each contain five 5-inch wheels mounted side by side. As the work through-feeds between opposing wheels, a hollow-ground edge is produced.

Honing then removes the tiny wire along the edge. The hones are spiral bodies—produced in the plant's tool-room on a special-purpose machine—and revolve away from the edge. Contact with the work is along a continuous line. Station spindles are geared together so that the line of contact on both sides of the work is always identical. The hones at the three stations in the line have progressively finer grain sizes. The final hone is almost perfectly smooth and is extremely hard. At the end of the line, inspectors keep a close check on blade profile and dimensions and order any needed adjustments of the grinding and honing spindles.

Single-edge blades have a characteristic rib, or back, covering the unground edge. After the backs are blanked, embossed with the brand name, and formed, they are assembled to the blades automatically on a battery of machines of ASR's own design. A close-up view of one of the units is shown in Fig. 3.

Blades, feeding into the machine horizontally, meet backs coming down a chute. Fingers push each blade down into a back in position between a hammer and anvil. A cam then operates the hammer, crimping the back. The assembled blade enters an outgoing magazine, and at suitable intervals, the operator will remove a stack by threading a rod through the central slot in the blades.

Double-edge blades and reversible type single

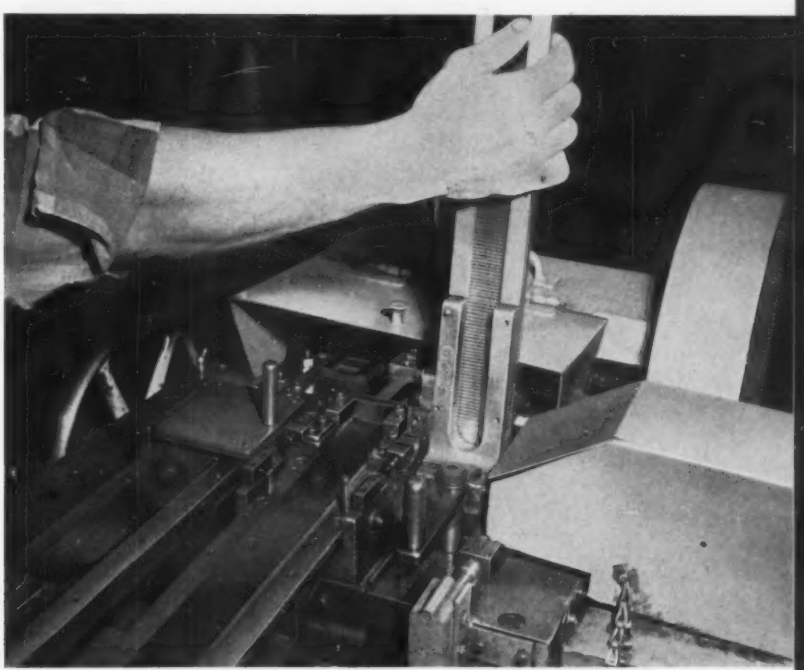


Fig. 3. This machine automatically assembles and secures backs to single-edge blades. The backs are loaded in the vertical chute and the blades feed in horizontally.

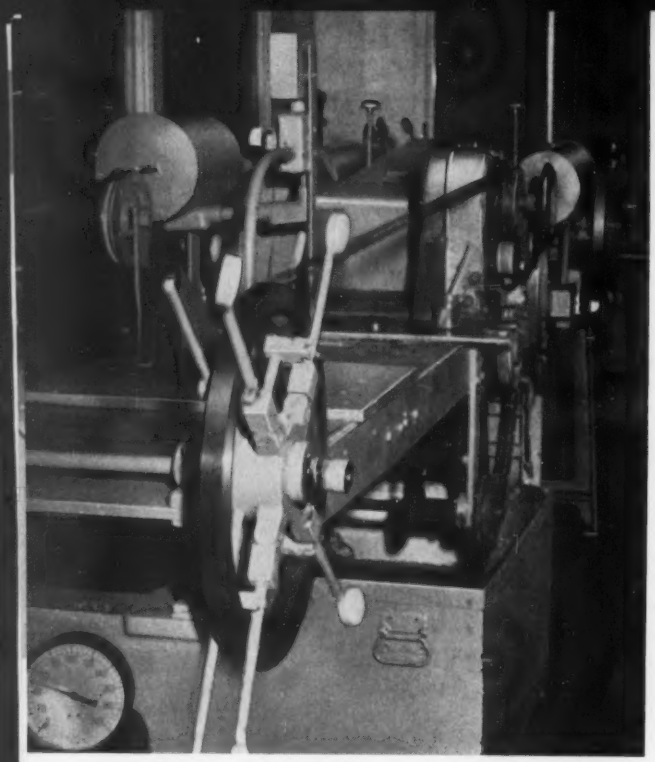


Fig. 4. After double-edge blades are perforated and heat-treated, brand names are etched on this machine. The operator has only to load and unload the reels at each end, the etching process being entirely automatic.

edge blades are etched with brand names and trademarks before being ground and honed, and while still in strip form. This operation is performed in a glass-enclosed room, in order to confine the corrosive vapors emanating from the etching fluid. Symmetrical construction of the etching equipment permits two lines of strip to be processed at the same time, one on each side of the machine.

An etching line is shown in Fig. 4. The strip is unwound from the reel in the foreground, rides over a driving sprocket, and is then directed downward between two rubber wheels carrying the "negative" of the lettering to be etched on the blade surfaces. Both wheels also are in continuous contact with rollers containing acid, which thus is transferred to the wheels and etches the strip. Leaving the wheels, the strip dips into a lime-water rinse in a tank beneath the machine. It is then raised and passes through a small electric drying cylinder onto another reel where it is rewound.

Blade quality is controlled in a 100 per cent inspection by skilled personnel. Inspectors stack the blades on trays in three rows of 350 pieces each, seen in Fig. 5. Each tray is supported over a ball-joint pedestal. By swiveling the tray to different positions, light is reflected from the rows at various angles. Any high, low, or nicked blades are immediately discernible in the mirror-like appearance of the row. These are removed, and where possible, salvaged and sold for various industrial uses.

Fig. 5. Reflection of light from the rows of blades immediately discloses any imperfections. Ball-joint mount of the tray pedestal permits swiveling.

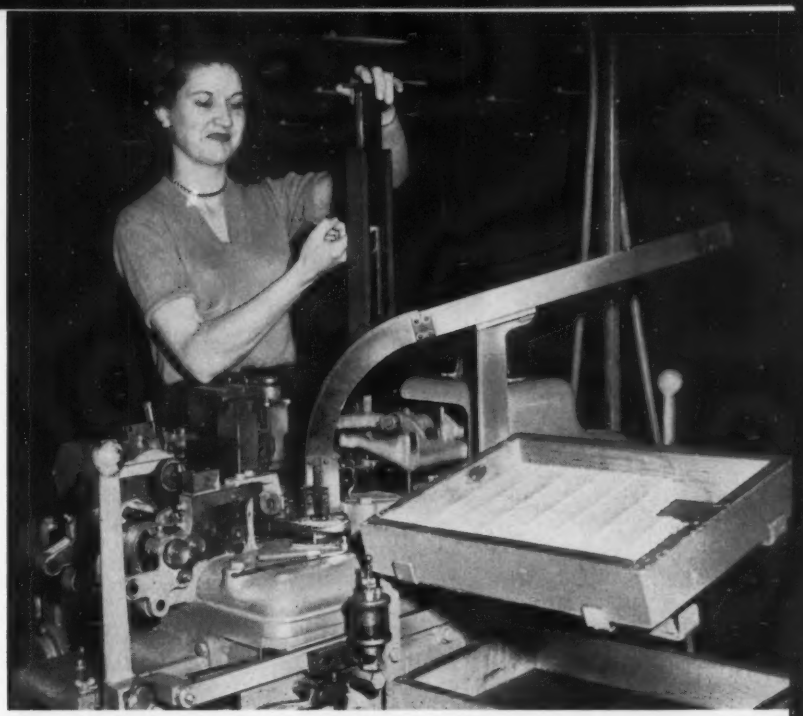


Fig. 6. To wrap the blades, machinery incorporating a dial principle is employed. Blades, hand-loaded in a chute, meet waxed paper cut from a roll. Wrapping progresses with each indexing of the dial table.

To test sharpness, the inspector selects a blade at random from each row and proceeds to slit a length of hair with it. From the amount of resistance offered by the hair, the deft fingers of the operator are able to sense any deviation from the required degree of sharpness. Final tests for sharpness and uniformity are performed by microscopy, and also by use of an ASR-designed electronic device called a Sharpometer.

Machinery for wrapping the blades might be considered the most intricate and interesting of any in the plant. In Fig. 6, for example, is illustrated one of the double-edge blade wrapping machines.

The blades are loaded in a chute and fed individually onto an indexing dial table. At the same time, printed waxed paper that has been automatically cut from a roll held on the side of the machine enters the dial at another point. The blade and paper meet, and at various stations around the dial the necessary series of folding motions is completed. At the unloading station, the wrapped blade moves up a discharge chute.

Manufacture of the company's safety razor

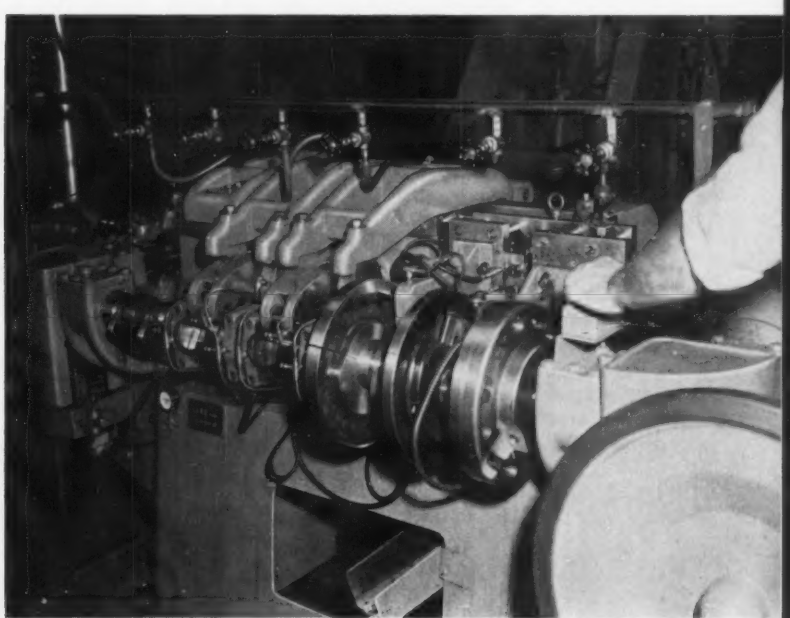


Fig. 7. This multiple-slide machine converts the brass strip into cover pieces, two at a time. In foreground can be seen some of the cams on the shaft system.

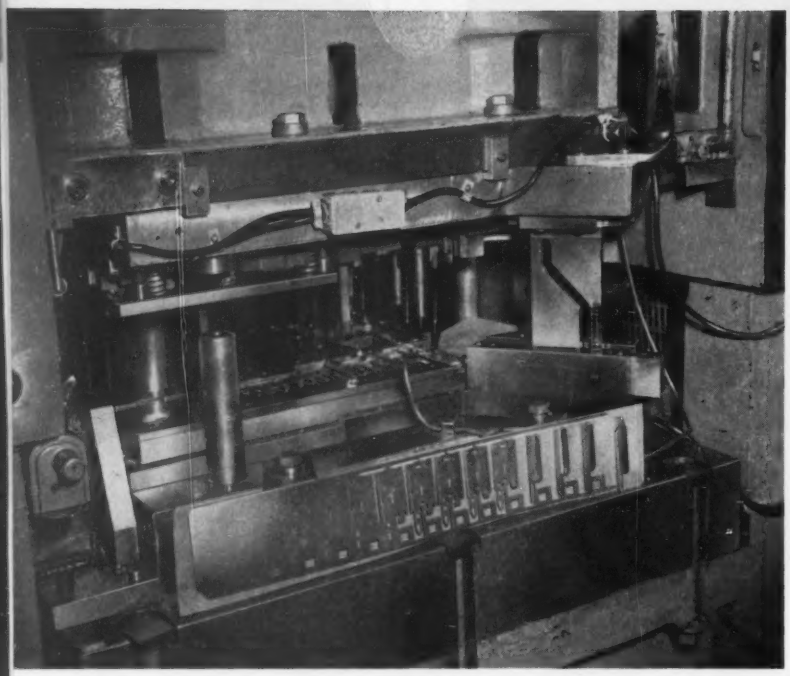


Fig. 8. Injector blade dispensers are produced on this press using a fourteen-stage progressive die. The transition from strip to finished part is illustrated by the ribbon at the front of the bed.

lines is also completely integrated at Staunton. For stamping operations, heavy reliance is placed on high-production techniques, like the use of multiple-slide machines and progressive dies. In Fig. 7 is shown a U. S. Multi-Slide machine as it turns out the cover piece for the single-edge razor.

The material for the covers is 0.040-inch thick brass strip, furnished in coils 2.812 inches wide. Two covers are produced at a time. Following preparatory straddle-milling, the strip is fed to the Multi-Slide and goes through eleven stages of piercing, blanking, forming, and parting operations. A shaft system surrounds the bed of the machine and, by means of cams and eccentrics, powers horizontally operating slides to which the various die sets are fastened.

The bridge piece of the razor is also made on this machine. Another Multi-Slide makes springs for single-edge blade magazines and clips for injector blade dispensers.

The dispenser itself originates as 0.039-inch thick aluminum strip, 3 11/16 inches wide. After being unwound and straightened, the material

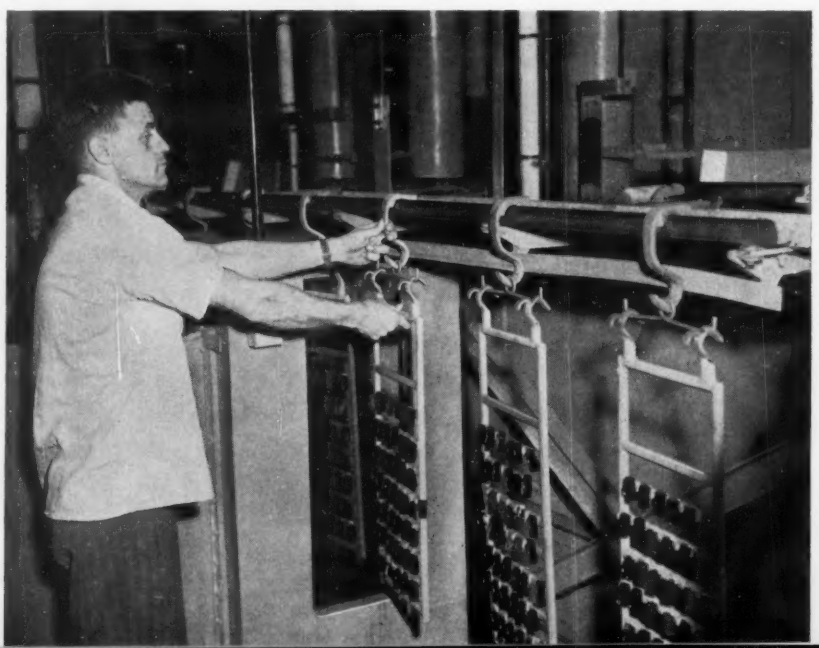


Fig. 9. Removing a rack of blade cover pieces from the plating line. A conveyor system elevates, advances, and lowers the work between stations.

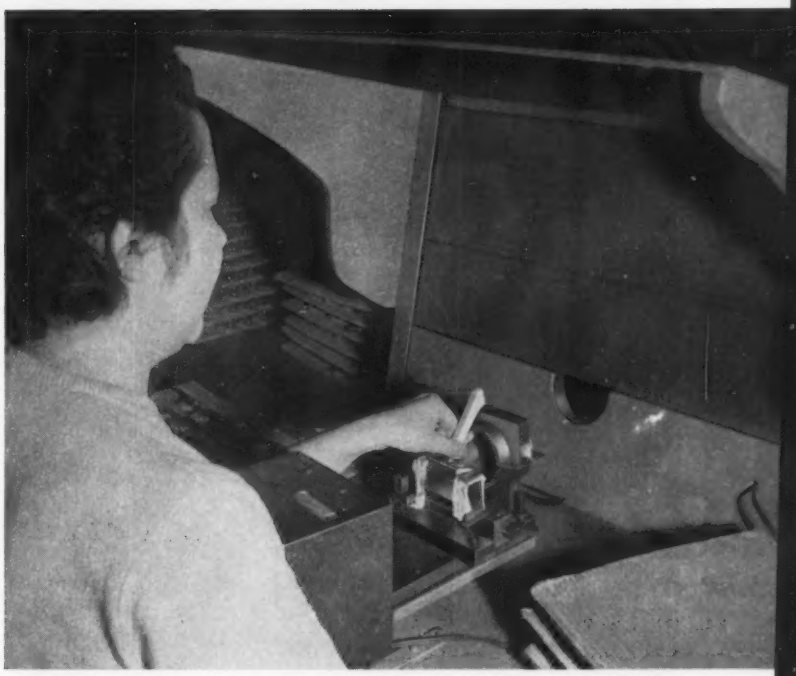


Fig. 10. This projector is one of several of ASR's own design for checking the amount of blade exposure in the finished razor. The plastic handle seen on razor is made by injection-molding department.

enters a Bliss open-side press, Fig. 8. Here, a fourteen-stage progressive die produces the ribbon seen on the front of the bolster plate, thus completing a dispenser with each press stroke. The operations involved include scoring, piercing, embossing, blanking, forming, sizing, and parting.

A well-mechanized plating department finishes the razor parts after they have been stamped. Following a Metalwash cleaning, burrs and sharp edges are removed by tumbling. For the necessary buffing in preparation for plating, many parts are put through an automatic cycle on a Packer-Matic rotary indexing machine.

Parts are hung on racks and enter a Udylite plating installation. The sequence consists of three alkaline (Oakite) hot cleaner baths, sulphuric acid dip, bright nickel bath, rinse, chromium plating bath, spray rinse, hot rinse, hot air blow-off, cold air blow-off, and oven drying.

In Fig. 9, racks holding single-edge razor covers are shown being removed from the oven. A chain conveyor system eliminates all handling through the twenty-seven-minute cycle.

Components like single-edge blade dispensers and razor handles are made of styrene plastic. For these, the plant is equipped with extensive injection-molding facilities.

For quality control of razor production, the company has developed its own optical projection methods. One of the critical inspections is shown being performed in Fig. 10. This is a check of the blade exposure of a finished razor. Tolerances are set at plus or minus 0.001 inch.

Exacting Met by

By WALTER McCADDEN
Chief Tool Engineer
Mechanical Division
General Mills, Inc.
Minneapolis, Minn.

CREATIVE engineering and production skill have been combined by the Mechanical Division of General Mills to manufacture ultra-precise components for electromechanical systems required in airborne navigation, armament, and control mechanisms. Gear trains for such mechanisms must have almost imperceptible backlash, a total cumulative error of 0.0002 inch, angular tolerances within 1 minute of arc, and positioning accuracy within 0.01 per cent. Dimensional tolerances specified for other mechanism components are frequently as little as 0.0001 or 0.0002 inch.

Competence to consistently meet such exacting precision requirements has been achieved by rebuilding standard machine tools to provide greater accuracy, designing special machines, and devising ingenious attachments. Some of the ma-

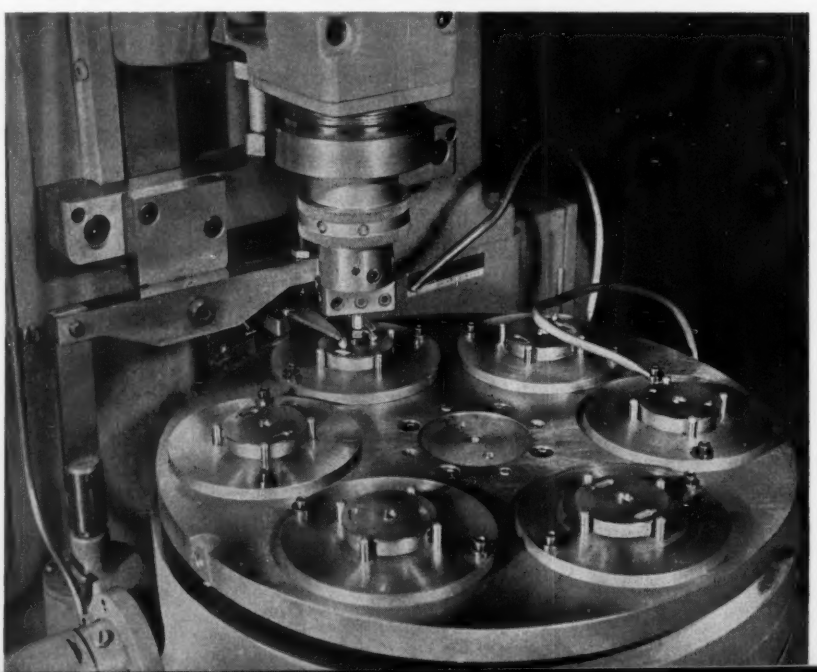


Fig. 1. Gear blank is clamped by means of two air-operated fingers at boring station of special machine seen in the heading illustration.

Precision Requirements Special Tooling

chines are operated under closely controlled temperature and humidity conditions. Many precise instruments and inspection devices are employed to insure adherence to the extremely close tolerances specified. One device can be used to divide a circle into 648,000 parts for measuring gear teeth.

Gear blanks are accurately bored and chamfered at production rates up to 600 per hour on the special machine seen in the heading illustration. This vertical boring machine, designed and built by the Mechanical Division of General Mills within four months of its conception, has a completely automatic cycle. It is only necessary for the operator to load blanks and remove bored parts while other work-pieces are being machined. A six-station dial type indexing table is synchronized with the vertical movement of a Heald precision boring head. The spindle is belt-driven at a speed of 3400 R.P.M. by a 1-H.P. motor, and fed at a variable rate by a hydraulic pump unit driven by a 3/4-H.P. motor. An air cylinder is used to index the table.

A work-piece is dropped in each nest as it is indexed past the operator's position at the front of the machine. The gear blanks fall onto support bosses, and are centralized by four hardened dowels projecting vertically from each nest. When a blank has been indexed to the machining position at the rear of the table, the boring head is automatically fed downward. During this travel, the head trips a cam-operated air valve, thus actuating two fingers which clamp the blank, as seen in Fig. 1. After boring and chamfering, the head rises and the clamps are lifted. An electrical interlock prevents the head from being lowered until indexing has been completed.

In the set-up shown, spur gear blanks made from AISI Type 302 corrosion-resistant steel are being bored and chamfered at the rate of 400 per hour. The blanks are 2.188 inches in diameter and 0.037 inch thick. From 0.015 to 0.020 inch of stock is removed in bringing the bore to a diameter between 0.3750 and 0.3753 inch. Also, eccentricity between the bore and periphery of the blank is maintained within 0.0015-inch total indicator reading. A solid carbide tool is employed, and the chips fall down through the nests and indexing table. Cutting fluid mixed with compressed air is sprayed on the tool in the form of a mist, and a blast of compressed air is directed onto the unloading station to facilitate removal of the blanks from the nests.

Another feature of this special machine is that the work-holding nests can be quickly changed to accommodate different size work-pieces, since

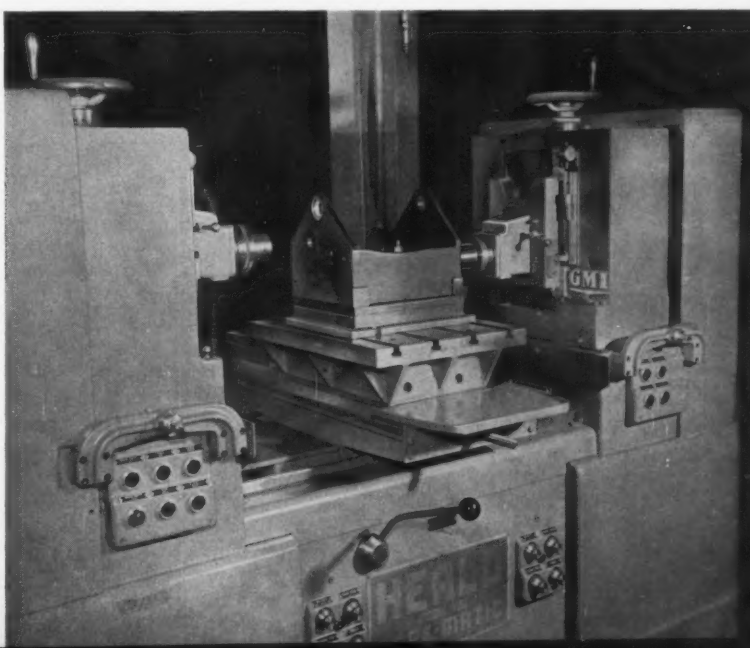


Fig. 2. Heads mounted on this double-end, precision boring machine can be accurately positioned by means of calibrated screws.

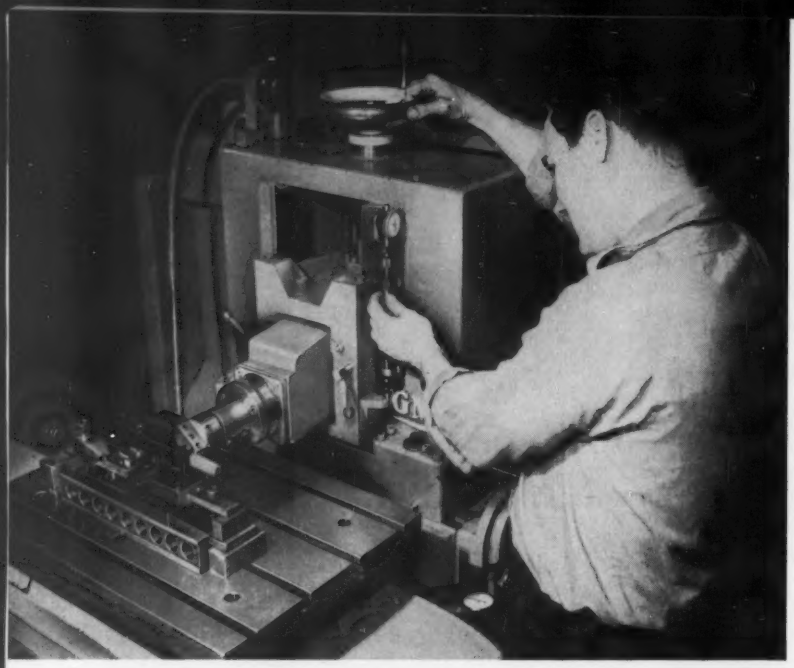


Fig. 3. By employing standard measuring rods and dial indicators, boring heads can be accurately located within 0.0001 inch.

each nest is secured to the indexing table by only two screws. In this way, parts up to 8 inches in diameter or 6 inches square, and having bores up to 3 inches in diameter, can be bored. At present, thirteen sets of nests have been provided to handle parts of different diameter, and each set accommodates several parts having the same diameter but various size bores. Also, a universal nest having adjustable jaws is used.

An example of the rebuilding of a standard machine tool to permit more accurate and faster setups for producing limited quantities of prototype parts is illustrated in Fig. 2. This Heald double-end, precision boring machine has been modified by mounting the boring heads on vertical dovetailed ways and providing calibrated screws for precise elevating or lowering of the heads. With the use of standard measuring rods and dial indicators, as seen in Fig. 3, it is possible to position either head within 0.0001 inch of the required vertical location. Also, cross-slides for both end units have been provided with calibrated screws and dial indicators for precise forward and back adjustments.

Previously, the standard heads on this machine had to be laboriously blocked up or shimmed, necessitating considerable time to change from one job to another. Now, with greatly improved flexibility and increased accuracy, the machine is ideal for boring various size gear-boxes and performing similar operations in small quantity, instrumentation type of manufacturing.

Total vertical adjustment of each head is 4 1/2 inches, and horizontal movement is 5 inches.

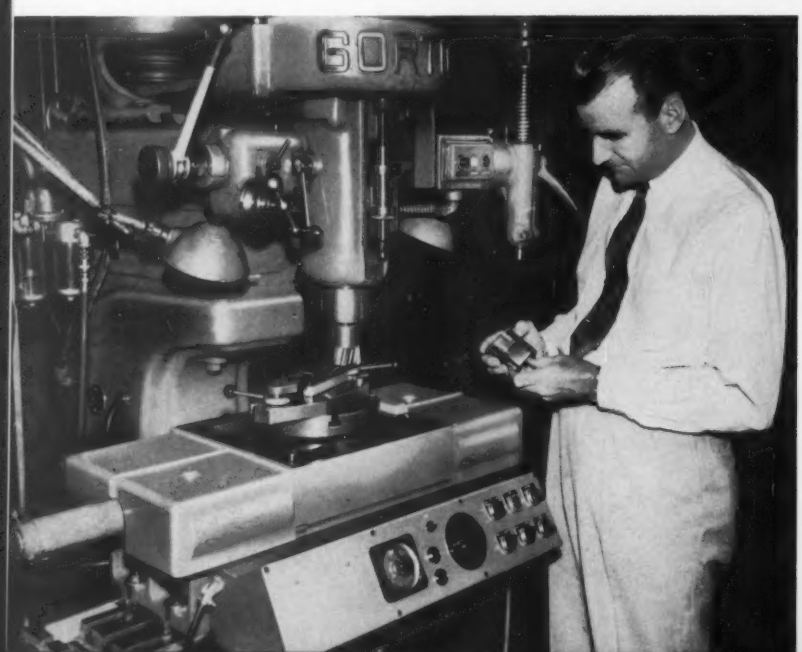


Fig. 4. Contouring attachment mounted on the table of standard vertical milling machine for producing precision cams and parts requiring extreme accuracy.

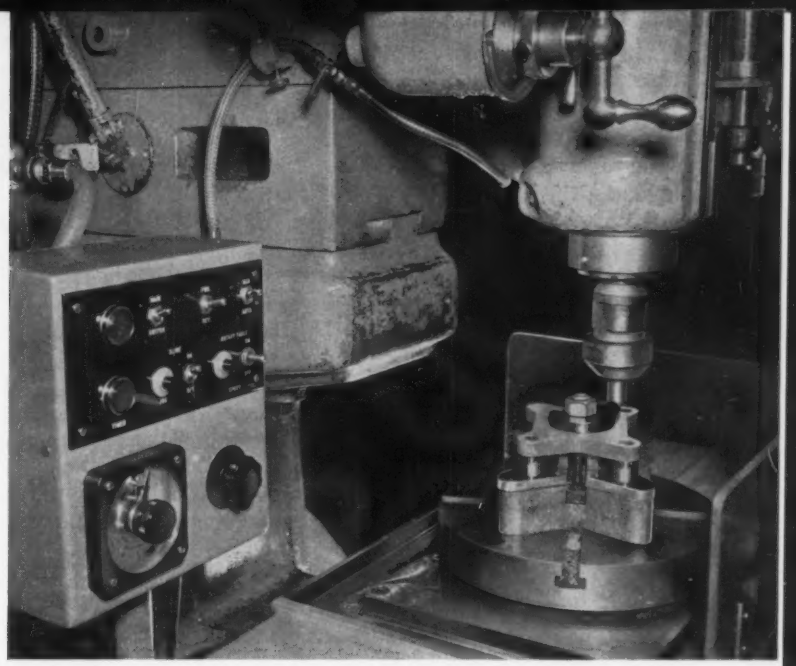


Fig. 5. Control panel at left contains cycling switches, an adjustable electrical timer, and a variable potentiometer for regulating the speed.

Further versatility has been afforded by mounting a special T-slotted table on top of the standard, hydraulically positioned table, which permits an adjustment of 18 inches from side to side and 8 inches front to back. Successful operation with this machine has led to plans for rebuilding a machine having two heads at each end.

Precision cams for instrument, camera, and gun components can be accurately produced on standard vertical milling machines by means of an ingenious contouring attachment devised by General Mills tool engineers. The automatic cycling attachment, called the "Auto-Contour," is shown in Fig. 4 mounted on the standard table of a Gorton 9-J vertical milling machine.

The contour-milling attachment consists essentially of a base casting having a carriage that is free to move longitudinally on balls. A vertical shaft carries the master cam to be duplicated and the work-holding arbor. The master cam is kept in contact with a roller by means of an air cylinder, and the roller is maintained in a fixed position but is free to rotate. Slow rotation of the work and master cam is accomplished with a direct-current motor, which has a selenium rectifier for current supply and a variable potentiometer to regulate the speed.

Set-up is made by means of the standard milling machine controls, bringing the cutter into contact with any point on the periphery of work-piece. Then, with the cutter-spindle maintained in a fixed position, the automatic cycle is started by actuating a switch on the control panel seen at the left in Fig. 5. The roller, kept in contact with the master cam, moves the cam, carriage, and work-piece together to the left or right—as required to duplicate the cam contour on the work. Removal of the cutter from contact with the work is automatically accomplished with an adjustable cycle electrical timer.

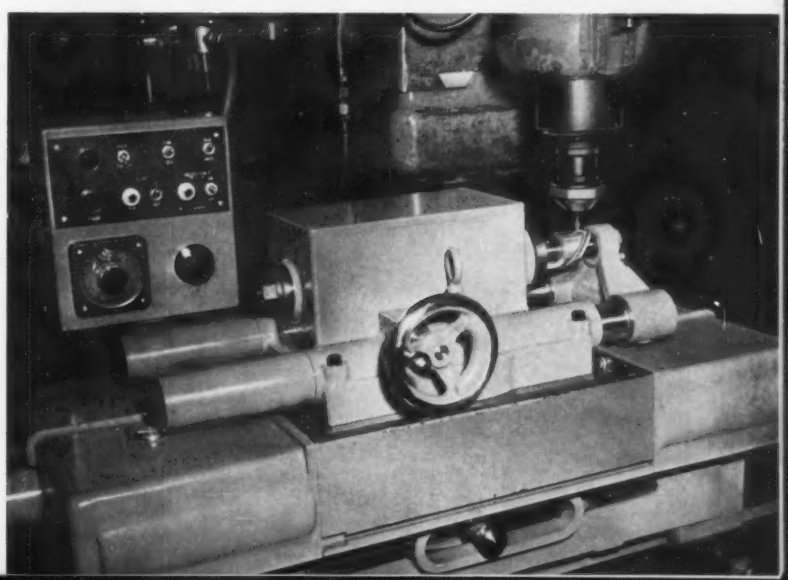


Fig. 6. Here a right-angle work-arbor has been mounted on contour-milling attachment to permit machining of profiles on both barrel and side cams.

Solid carbide end-mills of the same diameter as the roller and rotating at 2800 R.P.M. are employed for this operation. The work speed can be varied from 1/6 to 1.4 R.P.M. Parts up to 10 inches in diameter (or having a maximum radius of 5 inches from a common center) can be contour milled. Thin parts can be cut in multiple by stacking them on the arbor, and as many as ten cams have been cut simultaneously in this way. The accuracy of the master cam is duplicated within 0.0002 inch. Surface finish produced on the work-piece will vary with the condition of the cutter, but is generally between 13 and 15 micro-inches r.m.s. on high-production runs.

Versatility of the contour-milling attachment has been greatly increased by providing an interchangeable right-angle work-arbor, Fig. 6. This permits contour milling of barrel and side cams. Rotation of the horizontal work-arbor is synchronized with the vertical spindle of the attachment by a bevel gear drive. An outboard work-arbor support is mounted on two shafts which are retracted by means of a handwheel and rack mechanism to permit loading and unloading the work.

Success attained with this attachment has led to the design of a heavy-duty unit for use on larger milling machines. Such attachments are much cheaper to build than special cam-cutting machines for limited production quantities. Also, they permit the machines to be used for conventional operations when not required for cams.

Quality Control System Relies on Contour Projector

To achieve quality control in any metal-working plant, quality must first be defined. Blueprints and specification sheets are the commonly used rule books of quality control. To apply them in practice, however, they must be used in conjunction with an accurate checking medium.

Upgrading of product quality is a continuing project at the Chicago Screw Co., Bellwood, Ill., manufacturers of specialized threaded units and assemblies for the automobile, aircraft, and farm machine industries. Aiming toward this goal, machine operators and supervisors have been trained to start each production run with a thorough check of the tools assigned to them. This practice sets a work-cycle pattern in which nothing is taken for granted.

At regular intervals during the course of manufacture, the operator pulls a production sample from his machine for a routine check on close-tolerance specifications. Overseeing this phase of quality control is a crew of highly trained roving inspectors. In the event of a disagreement between the operator and the inspector regarding the accuracy of a part, visual proof of the exact dimensions is furnished by a Kodak contour projector that is installed on the shop floor.

An operator can check a threaded part completely, including pitch diameter, lead error, pitch, depth of thread, and helix angle in approximately four minutes. Tolerance checks can be made to within 0.001 inch. Line spacing on the projector chart is in representative increments of 0.001 inch.

In addition to the projection of work-piece contours, the machine is equipped to provide surface illumination on an object for measuring sockets and other blind holes. A revolving fixture enables the helix angle of the threads to be checked.

Contour projector takes the guesswork out of a quality control program dealing with precision-threaded products.

Impact Extrusion of Aluminum Counter Wheels and Pinions

ELECTRICITY meters manufactured by Ferranti, Ltd., Lancashire, England, are supplied with either a gear train and dial registering mechanism or a roller counter mechanism. Sensitivity in operation is of major importance, in order that the meters can accurately register a specified minimum electrical load. Since efficiency in this respect is largely determined by the amount of friction and inertia in the meter mechanism, weight of the moving parts, proportions for the bearing surfaces, and accuracy must be given careful consideration.

Both the rollers and pinions for the counter mechanism are made from aluminum in order to be lightweight. The design of the number roller is illustrated in Fig. 1; and in Fig. 2 is shown the associated pinion which meshes with the twenty round pins on this roller, and the formed, toothed projection on an adjacent roller, to effect indexing. Bearing surfaces only 0.052 inch in diameter by 0.025 inch long are provided at both ends so that the parts rotate on their spindles with a minimum of friction. The parts have been designed so that they can be made by impact extrusion from virtually pure aluminum. This enables a very thin section to be produced to the required degree of accuracy.

The number rollers are impact extruded from round blanks approximately 3/4 inch in diameter by 1/16 inch thick (with a 3/32-inch diameter center hole), which are produced three at a time in a compound die. Impact extruding is then performed on a 60-ton geared press which operates at thirty strokes per minute. A sectional drawing showing the construction of the impact-extrusion die is given in Fig. 3.

The blank is loaded into a recess *A* in the die, and is extruded upward over the punch *B* to form the rim and inner boss, and downward into the die to produce the twenty projections and the outer boss. The bore is sized by the pin insert *C*, which enters the blank before extrusion begins, and is centralized and supported in the bored end of a round die insert *D*, the latter also acting as an ejector. In addition, there are twenty ejector pins *E* which rest on a lower ring *F* and determine the length of the extruded projections.

Ejection of the work-piece from the die on the up stroke of the press ram is effected by the lever *G*, upon which the insert *D* and three pins associated with the ring *F* bear. The knock-out lever is actuated by a latch *H*, which is pivoted on the punch-holder and spring-loaded into engagement. At a predetermined point in the up stroke, a dog on the latch strikes a cam-block *J* on the bolster to cause disengagement.

Ejection of the part from the punch is effected by an inner sleeve *K*, which is machined at its lower end to produce the boss form, and is spring-loaded downward by three pins *L*. The bore, produced in the component, is tapered to an included angle of approximately 11 degrees. A parallel portion, 0.025 inch long by 0.053 inch in diameter, is left at the end of the outer boss to form one of the bearing surfaces.

The next stage in producing the number roller provides for piercing the elongated hole seen at *X* in Fig. 1, which serves for angular location at subsequent operations, and is also used to line up the rollers during assembly of the meter registering mechanism. This piercing operation is performed in a hand press, angular location being

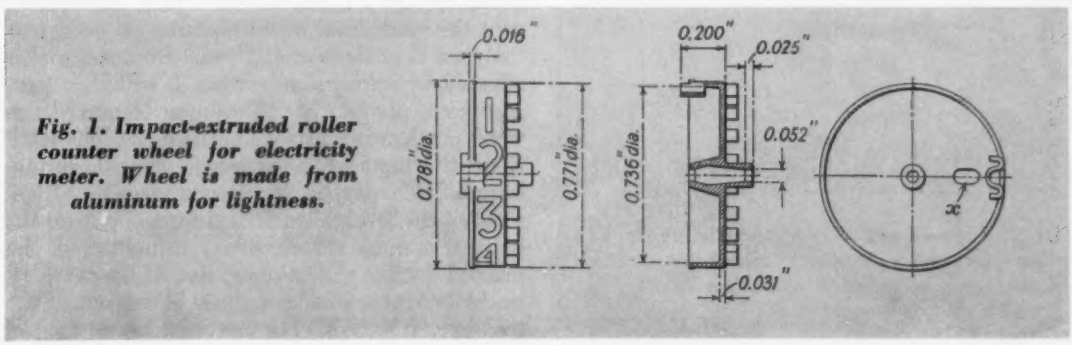


Fig. 1. Impact-extruded roller counter wheel for electricity meter. Wheel is made from aluminum for lightness.

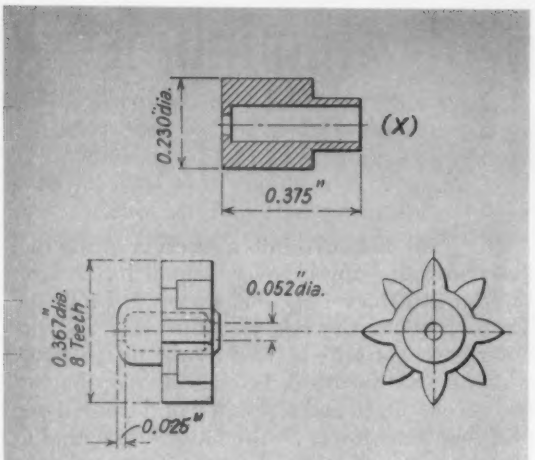


Fig. 2. Pinion used in conjunction with roller seen in Fig. 1 is impact extruded from the turned aluminum blank (X).

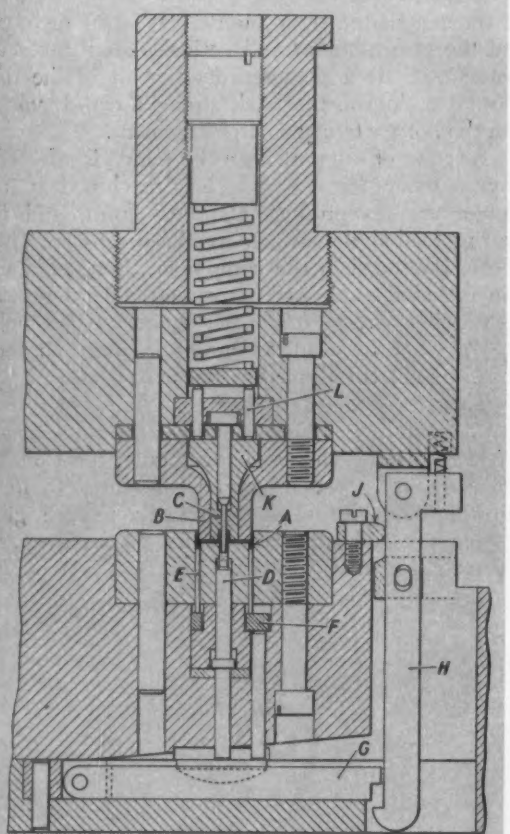


Fig. 3. Sectional view of the die employed for impact extruding aluminum roller counter wheels, such as shown in Fig. 1.

taken from one of the extruded projections.

As the metal is allowed to flow freely upward round the punch of the extruding tool, leaving a trimming allowance, there are two trimming operations required. In the first operation, the entire edge of the rim is trimmed to produce a part 0.200 inch high, as shown in Fig. 1. Prior to the second trimming operation, the rim is formed to produce what is termed the trap ring, which projects about 0.005 inch, and serves as a bearing surface for the alternate, cut-away tooth forms of the pinion while the latter is held stationary during operation of the counter. The second trimming operation is then performed to leave a lug which is subsequently slit and curled.

The first trimming operation is carried out in a hand press. Fig. 4 gives cross-sectional views of the tool for performing the second trimming operation. The work-piece is located, rim downward, on the fixed insert assembly *A*, and trimming is effected by four horizontally sliding punches *B*. These punches are actuated by cam-bars, as at *C*, attached to the top member of the tool. The latter also incorporates a spring-loaded pressure-pad *D* which holds down the work.

To trim the whole periphery of the work, the four horizontal punches operate in diametrically opposed pairs, one pair moving forward and returning before the other pair comes into operation, for clearance purposes. This requirement was met by designing the cam-bars *E*, to come into operation first, and effect both the advance and return of their associated punches during the down stroke of the press ram. Toward the bottom of the ram stroke, the cam-bars *C* advance the other pair of punches and return them immediately when the up stroke begins. The fact that the cam-bars *E* come into operation again later in the up stroke is immaterial.

Trimming takes place against a renewable washer member *F* on the insert *A*. The trimming punches are tenoned onto carrier plates, as shown, and are retained in their guide ways by top plates *G*. The rounded ends of plungers *H* enter holes in the trimming punches when the latter are in the withdrawn position, to avoid inadvertent inward movement which would prevent the work from being loaded.

Removal of the finished piece from the tool is effected by a lower ejector pin *J*, which is actuated by a pivoted bar. The latter is moved upward, on the return stroke of the press, by a latch *K* on the top tool, engaging a pivoted, spring-loaded latch on the knock-out bar. Disengagement of the latches is effected by a dog *L* on the bolster in conjunction with a cam face on the pivoted latch. A clearance slot *M* is provided in the bolster, and the scrap is blown out of the tool by a nozzle *N*. The button type air-control

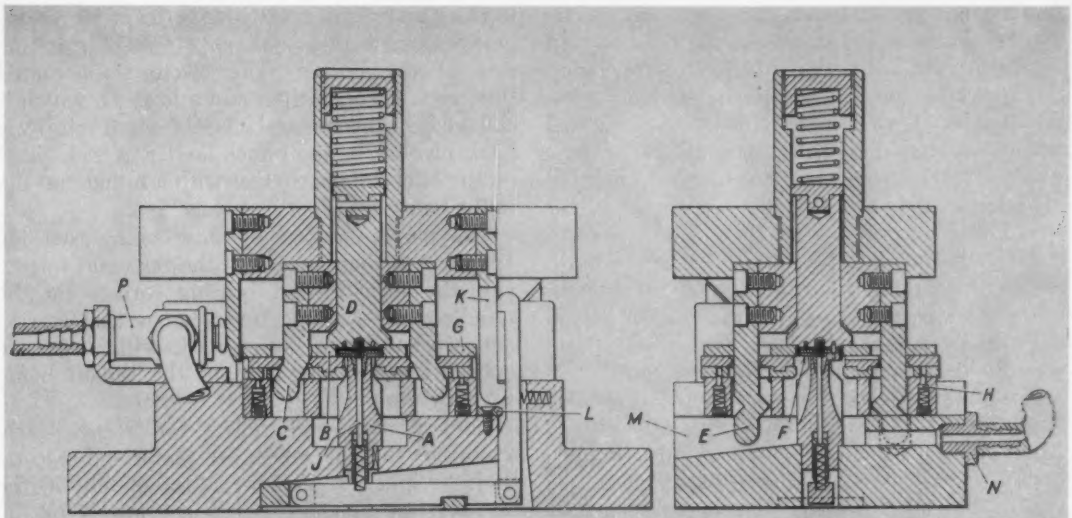


Fig. 4. Sectional views of the roller trimming die. Trimming is done by four cam-actuated, horizontally sliding punches (B).

valve *P*, mounted on the bolster, is actuated at each stroke of the press by a cam-bar attached to the top tool. A pin in the top of the insert assembly *A* engages the elongated hole in the part to locate it at the second trimming operation.

Forming of the trap ring, after the first trimming operation, is also carried out in a hand press. Fig. 5 shows the tool which has been developed for this purpose. The work-piece is loaded into a recess in the die-block *A*, and rests on the upper face of an ejector member *B*. Angular location is provided by a pin entering the hole pierced in the part for this purpose.

Expansion of the rim by the required small amount to produce the trap ring is effected by a spring collet member *C*, which is clamped by its upper flange between the members *D* and *E*. This entire assembly is free to slide axially against a return spring *F*. The collet is taper bored and is expanded by movement of the tapered end of sleeve *G*, which is fixed in the punch-holder. There is a spring-loaded pad *H* in sleeve *G*, which serves to hold the work-piece down in the die. During the downward stroke of the press ram, the collet *C* is arrested at the required forming depth by contact of the sliding member *E* with the die face. Continued downward movement causes the sleeve to expand the collet.

The trap ring form is not required at the point where the lug is subsequently to be left projecting from the rim, and a clearance space is therefore provided in the periphery of the collet. There is also a die insert at *J* which prevents spreading of the metal. Three small, spring-

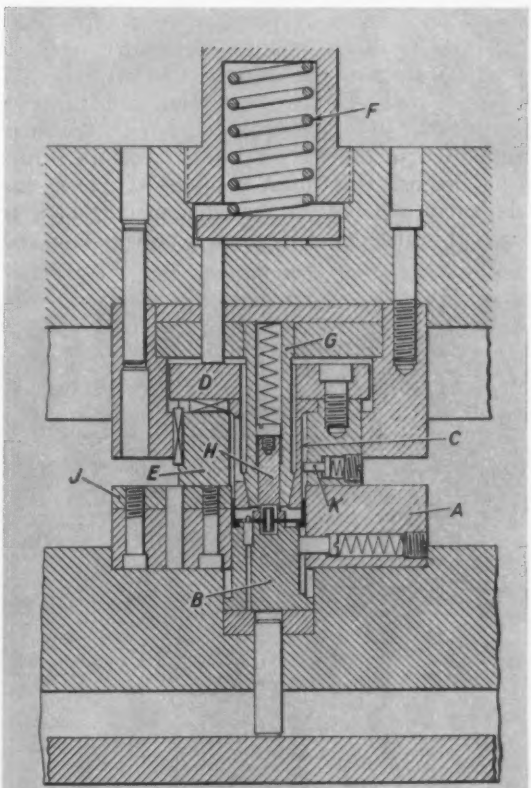


Fig. 5. Trap ring is formed on roller in this die. Expansion of roller rim is effected by a spring collet member (C).

loaded plungers *K*, bearing on the collet, insure that the latter closes to release the finished part on the up stroke of the press, after the taper-end sleeve has been disengaged. The lower ejector member *B* is actuated by a knock-out bar which is coupled to the punch-holder by long studs. Angular location of the collet and the sliding member *E* is maintained by keys, and of the ejector *B*, by a side plunger.

After the second trimming operation, following the forming of the trap ring, the inner boss of the roller is spun over to form the second bearing surface for the spindle. Facing operations are also performed.

The number wheel pinion is impact extruded from a blank *X*, (Fig. 2), which is turned on an automatic. The small-diameter end of the stepped bore in the blank is of the finished size required for the bearing. The extruding operation is carried out on a hand press, and a sectional drawing of the die is shown in Fig. 6.

The die *A*, into which the blank is loaded, produces the tooth form. Four die segments are shrunk into the ring *B*, so that the form may be produced on an optical profile grinder. The profile-ground punch *C* has a mating form, and alternate teeth are stepped on the end faces to produce the four pinion teeth that are required to be of reduced face width. Sizing of the bore is obtained by a spring-loaded pin *D*, which is supported in the ejector insert *E* before extrusion begins. This insert contains the form for the small end boss of the component, and it is carried in the sleeve *F* which is provided, on the top face and periphery, with a series of air release grooves connecting with an outlet hole in the side of the bolster. The ejector is actuated through a knock-out pin and a lever *G*, which is engaged on the up stroke of the press ram by a latch pivoted on the punch-holder. A cam piece on the latch makes contact with a round-end pin in the bolster to effect disengagement.

The part produced by this impact-extrusion operation is then formed at the boss end to provide the second short bearing surface for the spindle. This forming operation is also carried out in a hand press, using a die with a concave bottom surface, the bore of the pinion being sized by a pin.

Both pinions and rollers are subsequently anodized, and the rollers are then numbered on their peripheries. For the latter operation, the numbers are first impressed, in printer's ink, by the use of a small bench machine devised by the company. In this machine, the roller is gripped by the inner diameter of the rim in a collet, carried on a motor-driven spindle, and printing is carried out by contact with raised numerals formed on a rubber band attached to the periphery of an idler disc. Ink from a reservoir is applied to the raised numerals by a series of distribution discs. The printing serves only as a mask, so that, at the next operation—dyeing the anodized coating—the numerals appear the natural anodized color, on either a black or a red background, red being the color adopted for the first roller in the train which provides for indicating tenths of a kilowatt-hour.

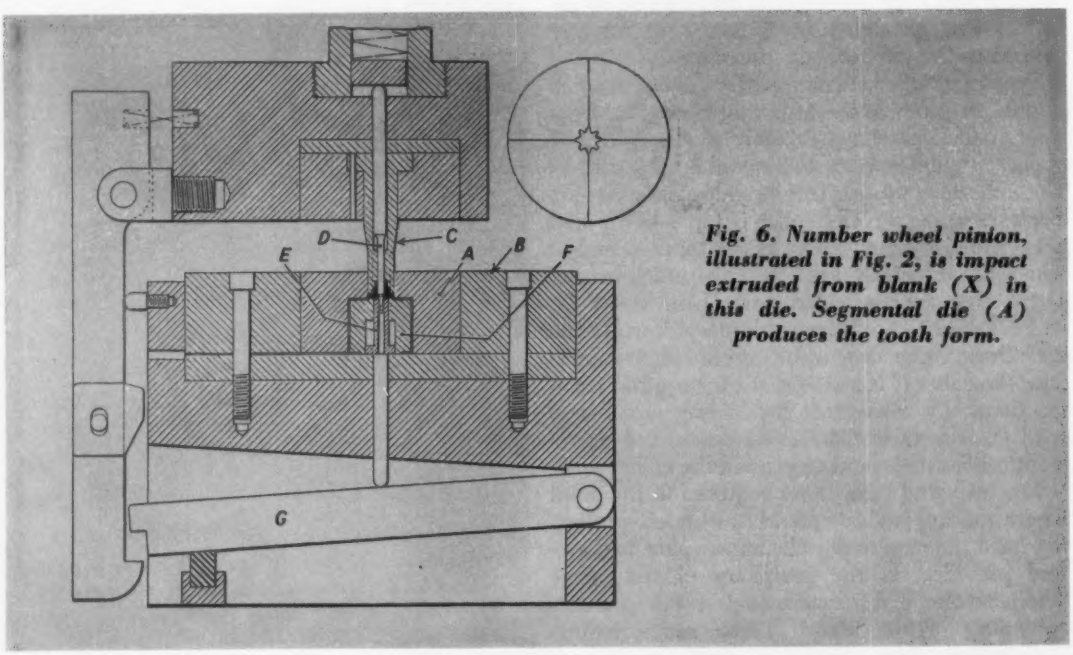


Fig. 6. Number wheel pinion, illustrated in Fig. 2, is impact extruded from blank (X) in this die. Segmental die (A) produces the tooth form.

Diesel Starters Involve Drilling Refinements

The transition from piston-driven to jet engines presents a challenge to the airplane propeller plant to diversify its operations. Here is how an important supplier has utilized highly flexible and automatic drilling machines to turn out a brand-new product.

By Edgar Altholz
Associate Editor

OPERATORS of Diesel-powered equipment are welcoming a new hydraulic starting system brought out recently by the General Motors Corporation. Completely self-contained, the system does not require the conventional combination of battery and starter motor.

The principle of the system is illustrated by the drawing in Fig. 1. There are five elements: starter assembly, accumulator, reservoir, engine-driven pump, and hand pump. The starter assembly consists of a piston type hydraulic motor connected through a clutch with a pinion which meshes with the flywheel of the engine in the usual manner. Engaging the clutch opens a port to the motor, and pressurized oil from the accumulator enters, causing the motor to function. Oil drains from the starter assembly to the reservoir, and from there it is pumped back into one end of the accumulator. At its other end, the accumulator contains a supply of gas, sealed off from the hydraulic oil by a piston. As the volume of oil in the accumulator builds up, the piston compresses the gas. Thus, when the starter-assembly port is opened, the oil is forced out of the accumulator at high pressure by the expanding gas.

The oil is pumped from the reservoir to the accumulator automatically by the engine-driven pump while the equipment is operating, so that after a shut-down there is a sufficient build-up in the accumulator to run the starter motor. The hand pump is included in the fluid circuit for emergency use, where it might be necessary to start the engine with no reserve pressure.

Manufacture of the hydraulic starter system is centered in the Aeroproducts Operations plant of General Motors' Allison Division, Dayton, Ohio. To expedite the drilling and related operations required by many of the parts, a battery of seven Natco H-6 heavy-duty machines has been installed. Natco (National Automatic Tool Co.) also designed and furnished the intricate work-holding fixtures.

The heading illustration shows one of the machines, here at work drilling and tapping a twelve-hole bolt circle in the clutch housing of the starter assembly. Basic machine design consists of a multiple-spindle geared head and a hydraulically fed table. Spindles are driven through universal joints, and are fixed in the required lay-out pattern by a plate fastened to the bottom of the head. As special equipment, the

table carries a hydraulic slide which shuttles the work-fixture between loading, drilling, and tapping positions.

A view of the fixture in loading position appears in Fig. 2. The clutch housing, a Meehanite casting, is previously bored and faced. Because of the close center distance of the twelve holes in the bolt circle, six alternate holes are drilled and tapped at a time, followed by a 30-degree indexing of the work for the drilling and tapping of the second six holes.

To provide for this indexing, the work rests on a small swivel table supported centrally over the fixture base. An apron at the front of the table contains a shot-bolt which can engage two bushed holes in the base representing the two positions of index.

Loading and unloading are rapid because of the absence of clamps. In the drilling position, the work is secured automatically, as the table feeds up, by being thrust against the bottom of a spring-loaded guide plate. Simultaneously, posts on the fixture contact pads on the bottom of the guide plate, serving to keep it level as it is forced up. To locate the fixture accurately, two of the posts have square projections which enter corresponding square holes in the bottom of the plate.

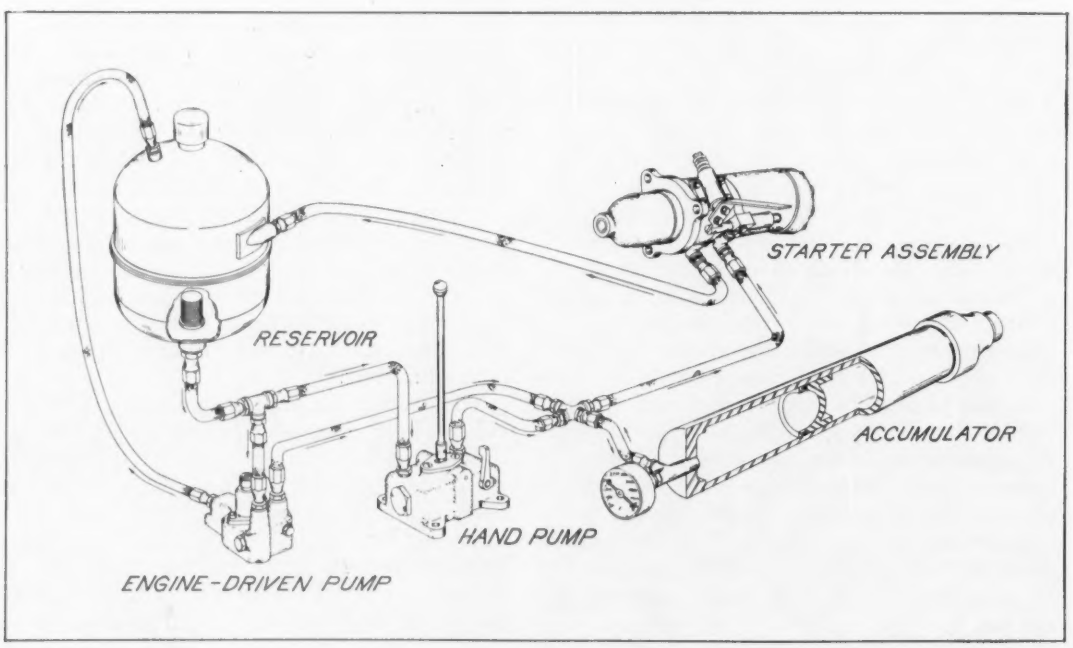
In the tapping position, the work is secured by a close-fitting spring-loaded plunger which enters the bore as the table feeds up. A second pair of square holes in the guide plate is used to locate the fixture in relation to the taps. To keep the plate level during the tapping, two additional posts are integral in an arm extending from the left side of the fixture.

Table movement in the drilling cycle consists of a rapid traverse up, feed up, and rapid traverse down. In the tapping cycle, it consists of a rapid traverse up, feed up, feed down, and rapid traverse down. One motor drives all drilling and tapping spindles, and automatically reverses for the withdrawal portion of the tapping cycle. Limit switches, visible along the hydraulic slide of the table, coordinate the cycling of the table with the position of the work-fixture. The spindle speed changes, and changes in the feed cycles of the table are performed automatically.

Sub-land drills are used—the small diameter serves as the tap drill (0.272 inch for the 5/16-24 taps specified), and the large diameter chamfers the hole. Spindles rotate at 832 R.P.M. for drilling and at 707 R.P.M. for tapping. Since all holes are blind, the taps have a relatively short lead of only two threads.

Another Natco machine, Fig. 3, is set up to drill and counterbore a series of holes in the starter-assembly adapter. This part, also a Meehanite casting, is a cut-away housing for the starter pinion. The holes are located at a flange at one end. Four holes are used to bolt the adapter to the assembly proper. Three other

Fig. 1. When the engine is running, the self-contained hydraulic system pumps oil from the reservoir to the accumulator.



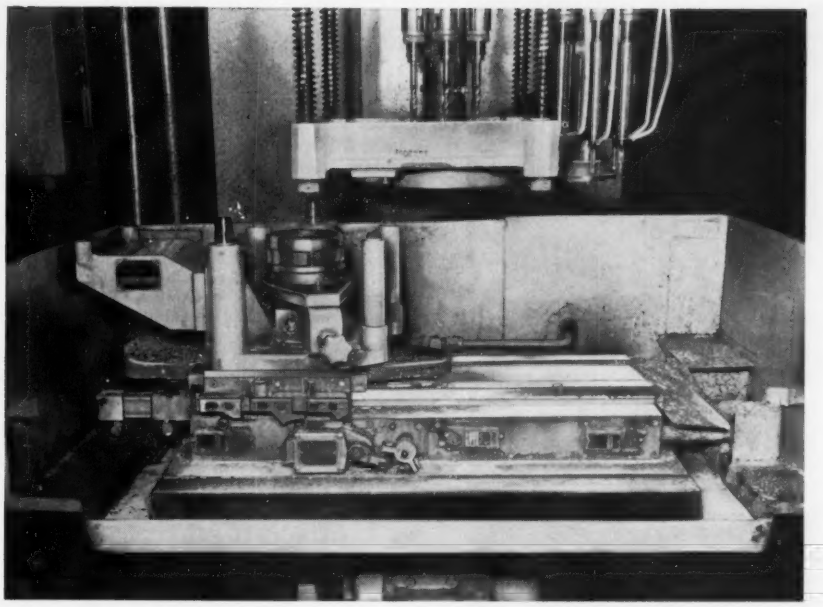


Fig. 2. The clutch housing is secured in the work-fixture in drilling and tapping positions by the thrust of the table movement upward.

holes, in ears on the flange, are used to secure the assembly to the Diesel engine.

As in the set-up considered previously, the table of the machine is equipped with a hydraulic slide which shuttles the work-fixture between three positions. The four-hole series is drilled in the first position and counterbored in the third position; and the three-hole series is drilled in the second position. Each side of the fixture contains an integral mechanism which actuates the two clamps securing the work. Cranks at the front of the fixture control pistons under the heel of each clamp. A slight upward movement of the pistons causes the clamps to exert a downward pressure on the flange.

Some of the other Natco machines have rotary indexing fixtures, permitting the processing of several work-pieces simultaneously. In each of the two machines in Fig. 4, for example, eight valve plates are in various stages of work. These are aluminum parts and form the heart of the starter assembly.

In the right-hand machine, two plates are loaded at each of four stations—one held hori-

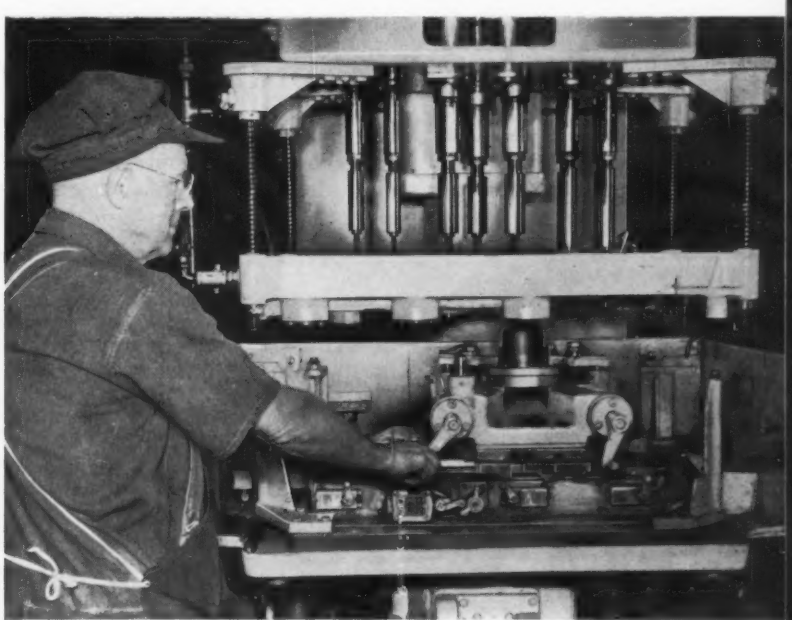


Fig. 3. By actuating cranks at the front of the work-fixture, pistons under the heels of the clamps are raised or lowered.

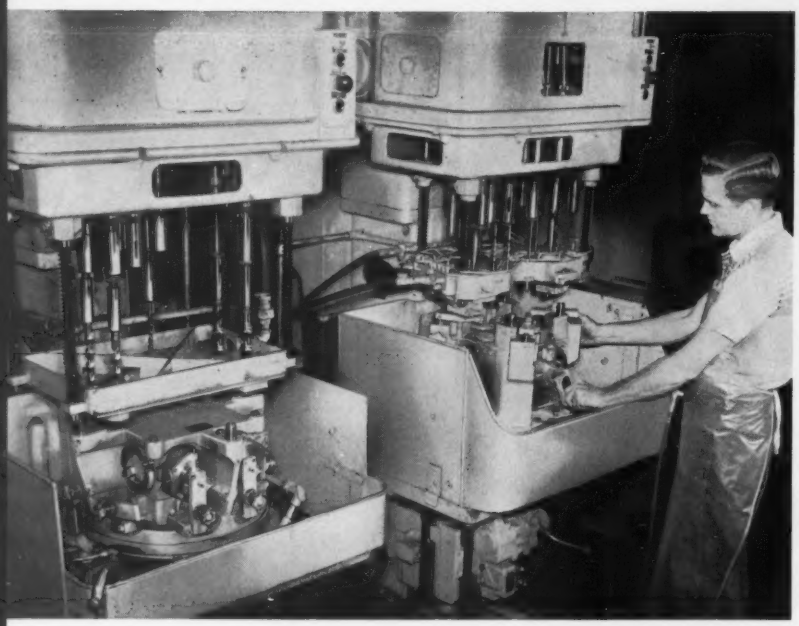


Fig. 4. The valve plate goes through two cycles of a rotary indexing fixture on each drilling machine.

zontally, the other vertically. After a plate completes one cycle in a horizontal position, it is shifted to a vertical position and goes through another cycle. In the horizontal position, five holes are drilled and two reamed in the plate as it indexes through the work stations. In the vertical position, three holes are drilled and the center of the plate is trepanned.

Parts are then advanced to the left-hand machine, where they are held horizontally in pairs at each station. The rotary indexing fixture goes through two cycles. In the first cycle, three holes are drilled. Then, the part is revolved 180 degrees and transferred to the other position at its station, and two holes are drilled in the second cycle.

Indexing of the fixtures is controlled by hydraulic shot-bolts. Several untooled spindles can be seen in each machine. These are utilized for a series of operations on the engine-driven pump body of the starting system.

Chip Control for Gun Drilling

CHIP control, one of the major problems in gun drilling, appears to be materially aided by a high-polarity oil compound that was originally designed for high-speed machining, according to a report from the Van Straaten Chemical Co., Chicago, Ill. Usually, trouble with chip control is caused by too rapid tool wear, too high a temperature, improper tool design, and failure of the chips to clear the hole rapidly. When heat is properly controlled, for instance, a brittle chip is obtained which breaks readily and clears easily.

Viscosity is also an important factor. In some cases, where pressure cannot be maintained with 100 second oil, because of poor pump conditions, the use of a heavier viscosity oil is recommended. Van Straaten, for instance, puts out four different viscosities to meet the needs of different operating conditions.

The usefulness of the high-polarity compound for gun drilling was discovered in a plant in which the chips would not properly clear the drill, causing excessive drill wear and breakage. Four holes, 23/32 inch in diameter, were being drilled through 14-inch thick SAE 4340 steel having a hardness of 24 to 28 Rockwell C. The drill was carbide tipped, turning at 1280 R.P.M. with a feed of 0.00009 inch per revolution. Oil was pumped at a pressure of 700 pounds per square inch from a unit having refrigerated coils.

With Vantrol 5468G, a light oil compound having polar additives and a special chemical balance, tool life increased 90 per cent over the oil previously used. The machine was run two days on one drill, cutting 56 holes before the drill showed wear. The chips were regular and uniform and readily cleared from the drilled hole.

Titanium Parts Deep Drawn in One Operation

Deep-drawn titanium parts never before made in one operation have opened up new design possibilities. Such work formerly called for multiple drawing operations with an intermediate annealing cycle being required before each subsequent draw.

By J. S. KIRKPATRICK
Vice-President—Research and Development
Brooks & Perkins, Inc.
Detroit, Mich.

USING the valuable experience gained as the largest fabricator of deep-drawn magnesium parts, Brooks & Perkins, Inc., Detroit, Mich., is actively engaged in forming parts of titanium. This work—including months of research and development time in perfecting titanium forming techniques—is being carried out without government sponsorship.

One important result of this continuing program is that deep-drawn parts such as those shown in Fig. 1 have been made in a single hot-drawing operation. All of the parts illustrated were made from Rem-Cru A-70 titanium, the part at the right being drawn from 0.062-inch thick sheet, and the other three from 0.035-inch thick sheet.

Deep draws of this type had never before been made in one operation, and it had been assumed by users of titanium that multiple draws were necessary, with an intermediate anneal required before each subsequent operation. With the lower cost made possible by this simplified processing, wider and more varied use of titanium is expected.

Other parts also made from Rem-Cru A-70 titanium in single-operation draws are illustrated in Fig. 2. These parts, left to right respectively, were drawn from 0.062-, 0.040-, and 0.035-inch thick sheet. The shapes are typical of those which can be made in one draw with no difficulty. Radii at the junctures of the sides with the bottom of the work-piece can be as small as 3/16 inch. However, on box draws, such as the one at the left, radii at the side corners should be at least 7/16 or 1/2 inch. Smaller radii can be held at the bottom of a box draw than at the side corners. The box shown at the left is 2 3/4 inches wide by 4 1/2 inches long and 3 inches deep.

Basically, titanium is structurally similar to magnesium, and, theoretically, techniques for deep-drawing and forming the two metals should be much the same. This has been found to be es-

Fig. 1. Typical parts deep drawn from titanium in a single hot operation. Part at right is 0.062 inch thick, and other three, 0.035 inch thick.

Fig. 2. Radii where sides join bottoms of drawn titanium parts can be as small as 3/16 inch, except on box draws, where radii of side corners should be at least 7/16 inch.

sentially true, and it has been proved that titanium, like magnesium, can be drawn more severely in one operation than comparable alloys of aluminum, steel, and brass.

While commercially pure titanium can be drawn into relatively simple shapes at room temperature, cold-forming is undesirable because of the close-packed hexagonal crystal structure and the variations due to spring-back of the formed part. The rapid work hardening of titanium when it is formed at room or relatively low temperatures makes it necessary to provide a stress-relieving heat-treatment prior to further drawing. Such stress-relieving entails heating the parts to between 900 and 1000 degrees F., maintaining them at this temperature for 30 minutes, and cooling in air. Severe deformation at room or low temperature may require a full annealing treatment at a temperature between 1250 and 1300 degrees F. in an inert atmosphere.

For deep-drawing of complex shapes, it is recommended that pure titanium, like magnesium, be heated. When hot drawn, it is possible to make initial reductions of 45 per cent or more.

Higher strength titanium alloys should be heated to somewhat higher temperatures to facilitate deep-drawing in a single operation and minimize spring-back after forming. The exact tem-

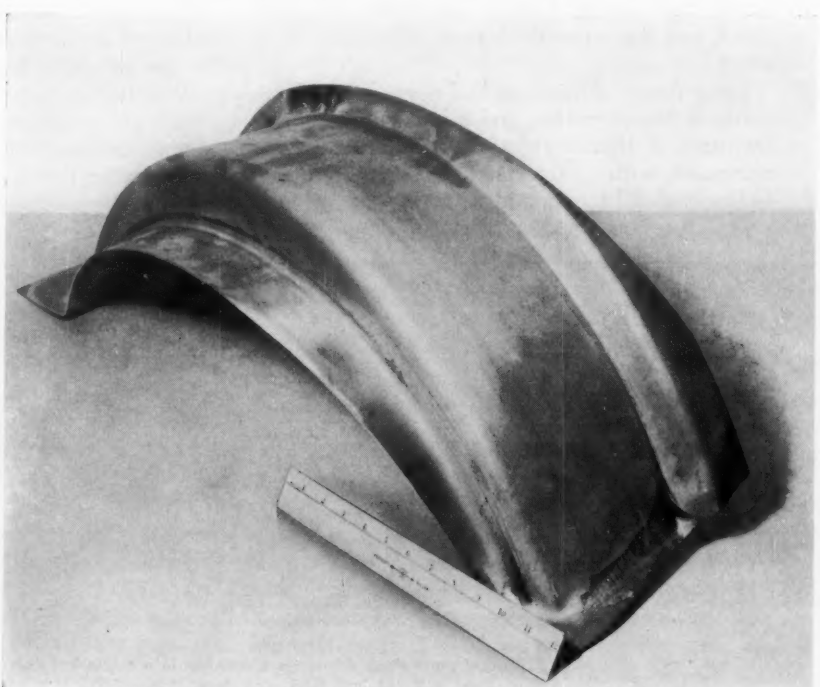


Fig. 3. Single draw in A-110 AT titanium from 0.062-inch thick sheet. This part will be employed as a compressor housing shroud for a jet engine.

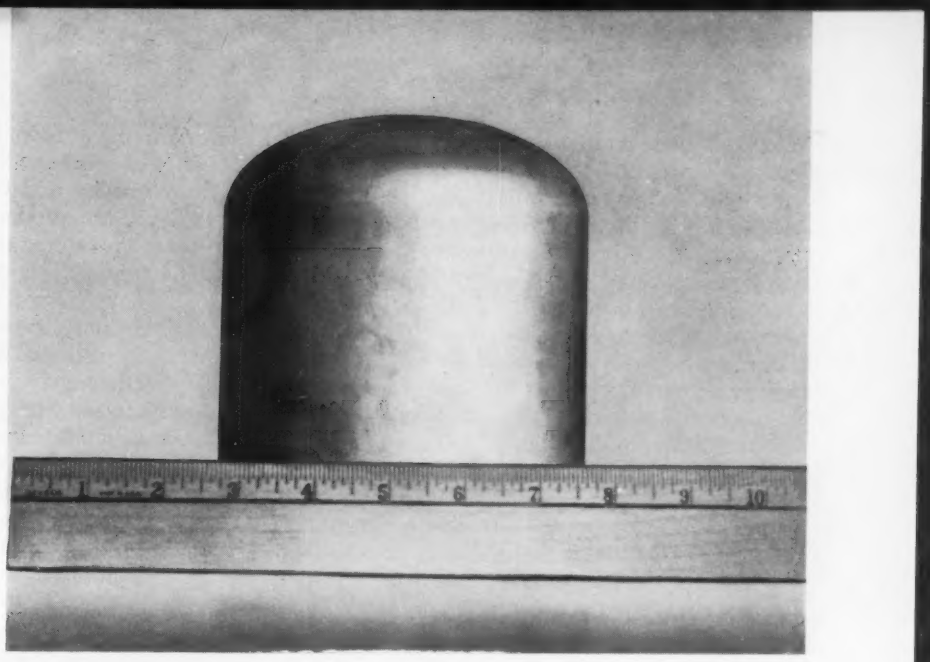


Fig. 4. Cylindrical part drawn to a depth of 6 inches and a diameter of 5 1/2 inches in one operation from 0.125-inch thick RS-110 BX titanium alloy.

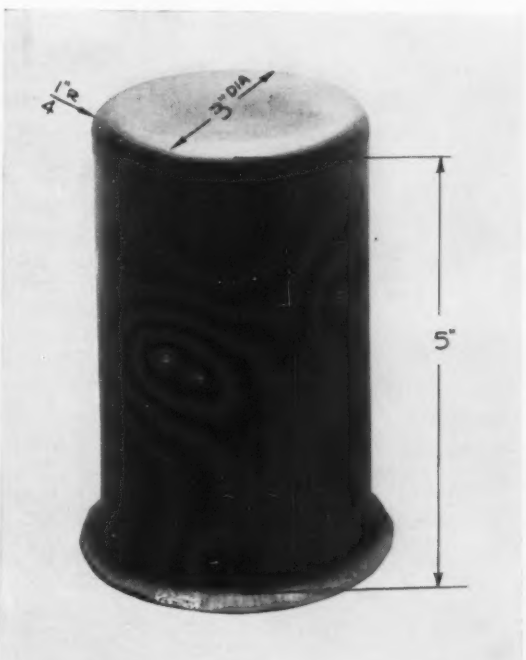
perature will vary with the alloy and design of the part to be formed. Heating of titanium sheets is performed by placing them either in natural gas-fired ovens or electrical resistance heaters of the waffle-iron type. For small-quantity production lots, the sheets need not be pre-heated. Instead, they are placed in the die, which is maintained at the specified temperature, and allowed to heat for approximately thirty seconds prior to drawing. Temperature of the die can be checked periodically by means of a portable optical pyrometer or by a contact type pyrometer. It is important that the titanium blanks be kept at the required forming temperature for only a short time to prevent embrittlement due to absorption of oxygen or nitrogen.

A compressor housing shroud, made in one draw from A-110 AT titanium, 0.062 inch thick, is shown in Fig. 3. A deep-drawn part of 0.125-inch thick, Republic Steel RS-110 BX titanium alloy is illustrated in Fig. 4. These parts are drawn to a depth of 6 inches, with a diameter of 5 1/2 inches, in one operation. After trimming, pairs of these parts are butt-welded together to produce pressure vessels.

Another cylinder hot drawn in one operation from 0.025-inch thick A-55 titanium is shown in Fig. 5. The 5-inch depth of this part is an unusually deep draw for a 3-inch diameter cylinder, and the results obtained indicate that in some cases titanium may be even easier to hot draw than magnesium. No difficulty was encountered in this drawing operation, and it is reasonable to suppose that had the punch been longer than 5 inches, a considerably deeper cylinder could have been drawn successfully.

Brooks & Perkins have worked with almost all of the newest titanium alloys, and cooperate with the metal producers in developing forming techniques for the various alloys. Also, considerable contract work is being performed currently. The more uniform quality of titanium sheets now available has been a major factor in the spectacular results that have been obtained in deep-drawing. Sheets rolled from material produced by the double-melt process and stress relieved by an-

Fig. 5. Another cylinder hot drawn in one operation is 5 inches deep and only 3 inches in diameter. Material is 0.025-inch thick A-55 titanium alloy.



nealing at the mill are preferred for such forming. The sheets handled have ranged up to 36 inches wide by 96 inches long, with thicknesses varying from 0.002 to 0.125 inch. Because of the limited-production quantities, the sheets are sheared to required size instead of making blanking dies.

Essentially, die design for deep-drawing titanium is the same as for hot-forming magnesium. Die clearances, from 0.004 to 0.010 inch, are slightly greater than those employed for forming stainless steel. Best results are obtained with slow working of titanium. The pressure exerted during drawing must be carefully controlled within close limits to prevent wrinkling or tearing of the material.

One major problem encountered in drawing titanium is the tendency of the metal to gall the die surfaces. If adequate and suitable lubrication is not provided, the dies will pick up small particles of titanium. Dies roughened in this way will scratch the work-piece. Various methods, such as surface oxidation, phosphate-coating, and copper-plating of the titanium sheet, have been tried to provide improved adhesion of the lubricant to the metal surface.

As with all elevated temperature operations, die lubrication is a serious problem. Conventional petroleum lubricants have been found to either decompose or distill off at the elevated temperatures encountered in drawing titanium. At this time, it is impossible to give specific recommendations as to which die lubrication will be best for titanium hot-forming. For commercially pure titanium forming at room temperature, the normal lubricants, of course, will work. For elevated temperature spinning and stretching, graphited tallow and yellow laundry soap both work fairly well. For temperatures above 500 degrees F., only two stable lubricants with satisfactory lubricating properties have been found; these are graphite and molybdenum disulfide. These materials may be used in the colloidal form with an evaporating vehicle, or they may be powdered on the die prior to the forming or drawing operation. Lubrication for elevated temperature work has been a problem of hot-working metals for many years. It is hoped that the interest in the hot work of titanium will inspire more research in this field.

Rubber-forming can also be used for contouring small quantities of titanium parts. In this method, tooling costs are relatively low since the part can be bent over a form-block by a rubber pad attached to the upper platen of the press. A typical part formed from 0.040-inch thick titanium in this way is illustrated in Fig. 6.

While aluminum parts are normally cold-formed by this process, titanium requires heating for optimum results. With heated form-block and blanks, the life of the rubber forming pad is relatively short. It has not yet been determined whether this process is feasible from a cost standpoint. The added rubber cost may well rule out rubber-forming as a production method.

Titanium may also be formed on press brakes, drop-hammers, and stretch-forming machines. For example, Fig. 7 shows a 9-foot long by 2 1/2-

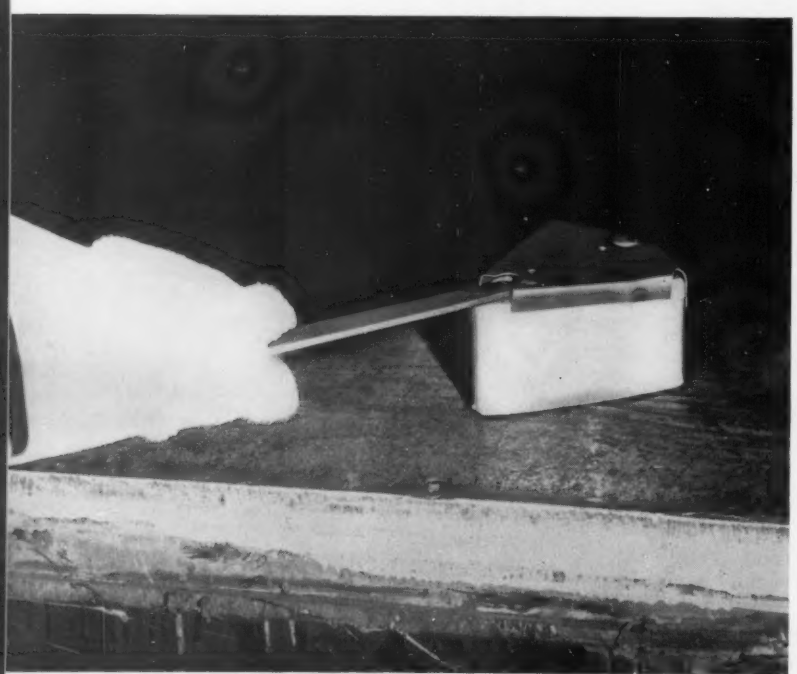


Fig. 6. Part formed from 0.040-inch thick titanium over a form-block by means of a rubber pad attached to the upper platen of the press.

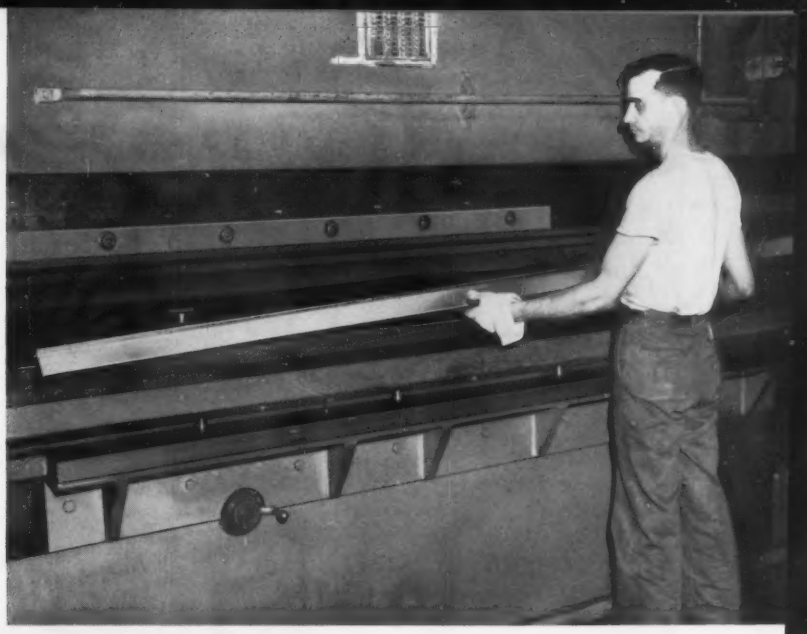


Fig. 7. (Right) Press brakes are also used for forming titanium. Here, a 9-foot long by 2 1/2-inch wide channel has been produced from 0.078-inch thick C-110M titanium.

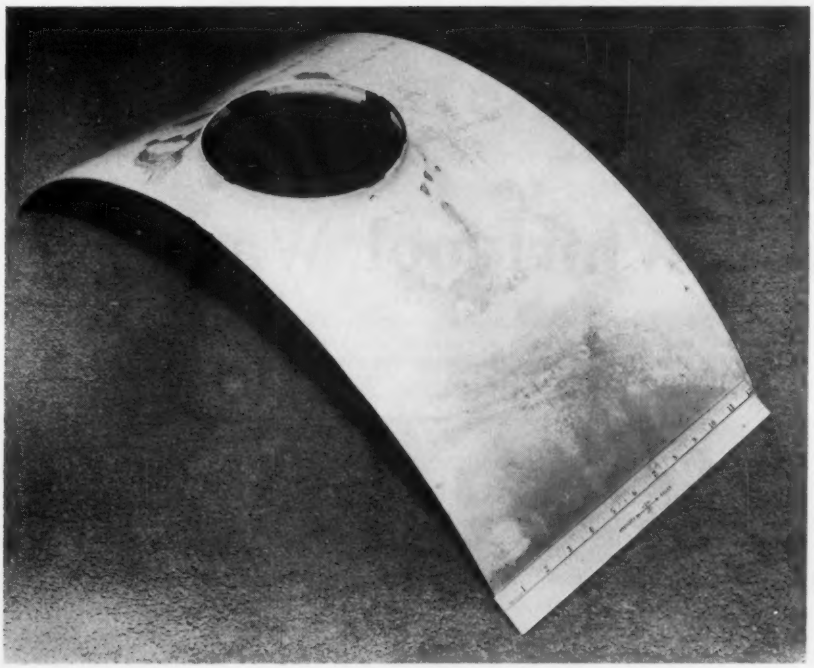


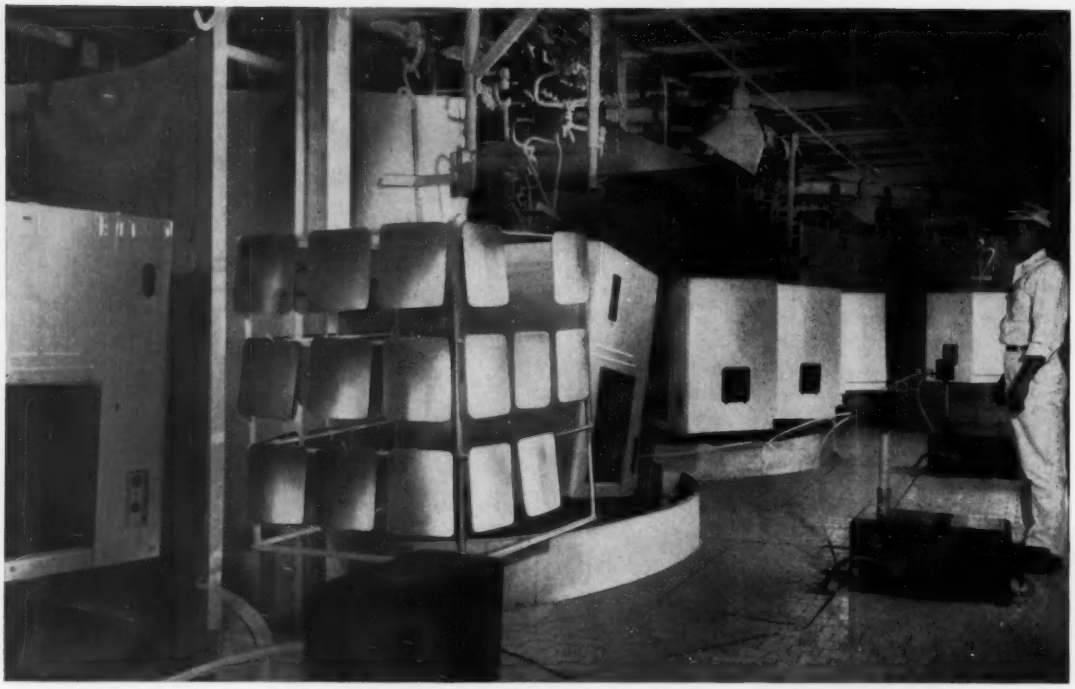
Fig. 8. (Left) Flanges are drawn in this aircraft jet-engine housing, which has been previously formed from 0.094-inch thick, A-110 AT titanium alloy.

inch wide channel formed from 0.078-inch thick, Rem-Cru C-110M titanium alloy on a press brake.

The high strength, light weight, and corrosion resistance of titanium promise a bright future for this newest of structural materials. Spurred by improved fabrication techniques, such as those described, more uniformity of the raw material, and lower costs, titanium is being applied more widely.

Jet engines and airframes represent the largest use. In such applications, titanium is used for jet-engine compressor wheels and housings; airframe bulkheads, webs, and shrouds; and the skin for an experimental supersonic plane. One aircraft manufacturer uses over 500 pounds of titanium per plane. One of the first commercial aircraft applications of titanium is for the nacelles and firewalls on the Douglas DC-7 airplane. Flanges in jet-engine housings, made from 0.094-inch thick A-110 AT titanium, are shown in Fig. 8.

Ordnance equipment represents another large use, with titanium being used for the baseplates and outriggers on Army 81-millimeter mortars and the mounts for 3-inch Navy guns. Another commercial application is for valve bodies used to handle corrosive fluids under high pressures.



Finishing the Whirlpool Washer

By DWIGHT EBERLY, Finishing Supervisor
Clyde Division, Whirlpool Corporation
Clyde, Ohio

EQUIPMENT that applies the final coat of paint to automatic washing machines electrostatically is the highlight of a completely conveyorized finishing line at the Clyde, Ohio, Division of the Whirlpool Corporation. This plant has been expanded to turn out one thousand automatic washers (both Whirlpool and Sears Kenmore models) daily, in addition to its regular work.

Preparation for painting consists of a thorough washing, followed immediately by Bonderizing. In Fig. 1, a cabinet and baseplate are shown after entering the tunnel-like Bonderizing unit. Parts are advanced by a monorail conveyor at a speed of 30 feet per minute. A seven-stage treatment is employed. In the first stage, the parts travel through a 30-foot long emulsion cleaner spray. The cleaner, a 1 to 50 solution of Solventol 62, is heated to 160 degrees F.

In the second stage, the parts are spray-rinsed with hot water. This spray treatment also requires 30 feet of conveyor travel. Bonderite 100 at 130 degrees F. is sprayed on in the third stage, creating a rust-resistant coating to promote paint adherence. Rinsing with demineralized cold water follows in the fourth stage, the water being continuously overflowed and recirculated. The fifth stage involves a Parcolene treatment, using a 0.5 per cent solution of chromic acid, sprayed on cold.

Next comes a final cold rinse in demineralized water sprayed on at 30 gallons per minute. There is a continuous overflow, which is fed back to the tank used in the fourth stage. In the seventh stage, the parts are dried in a direct gas-fired oven at 300 degrees F., then cooled, and conveyed to a flow-coating booth for primary painting. The booth entrance appears in Fig. 2.

Flow-coating is done with Glidden Nu-Pon, an oxidizing primer containing solvent. Viscosity is held to 19.4 seconds, as measured in a No. 2 Zahn cup at 80 degrees F. Application is by jets (as distinct from a spray) from nozzles on spinning arms. There are ten such nozzles, so placed

that all exterior and interior surfaces are coated. For a fifteen-minute interval, excess primer is allowed to drain off the parts and return to the supply tank. Coating and draining cycles are timed to leave a deposit of 0.2 mil minimum at the top of each part, and a 0.7 mil maximum at the bottom.

Baking the primer requires an oven temperature between 350 and 425 degrees F. for at least seven and one-half minutes. From the oven exit, the parts cool slowly as they are conveyed to a touch-up sanding area, a portion of which is shown in Fig. 3. Continuing on, the parts pass an inspection station, then are transferred to a "white line" conveyor leading to the finish-coating operation. Before entering the spray room, shown in the heading illustration, the work undergoes an air blow-off, then is rubbed down with a tack rag.

The spray room contains three Ransburg electrostatic booths. No guns are used, the spray being applied centrifugally from a horizontal disc spinning at 900 R.P.M. While the disc is spinning, it also moves up and down seven times each minute for a distance slightly exceeding the height of the cabinets, these being the largest parts in work. The smaller parts, as can be seen in the heading illustration, are arranged on racks to form a three-sided area for spraying similar to that of a cabinet.

The disc has a 45-degree bevel around the periphery of its under face. Paint fed to the top face is thrown off in a fine spray horizontally in all directions by centrifugal force at high velocity. Each particle thrown off the disc carries a positive electrostatic charge. Since the parts to be sprayed are grounded through the conveyor, they are electrostatically negative, and so have a strong tendency to attract the positively charged paint particles. Thus, by attracting the paint to the surfaces being finished, overspray is avoided. Water curtains are unnecessary, and booths need be cleaned no oftener than every three months.

All parts pass through the three booths in sequence. The work is rotated approximately 300 degrees in reference to the spray source. Approximately forty seconds is required for this travel. Normally, there are five loads in a booth at any one time, and about four cabinets, or other loads, are sprayed per minute. Between booths, each load is indexed 90 degrees, so that a different surface of the work is presented for spraying.

A white synthetic baking enamel (Nubilite 3279) is used. Its viscosity, held at fifteen seconds, as measured in a No. 4 Ford cup at 80

Fig. 1. A washing machine cabinet and baseplate are shown starting a 30-foot trip through the emulsion cleaner spray of the Bonderizing unit.

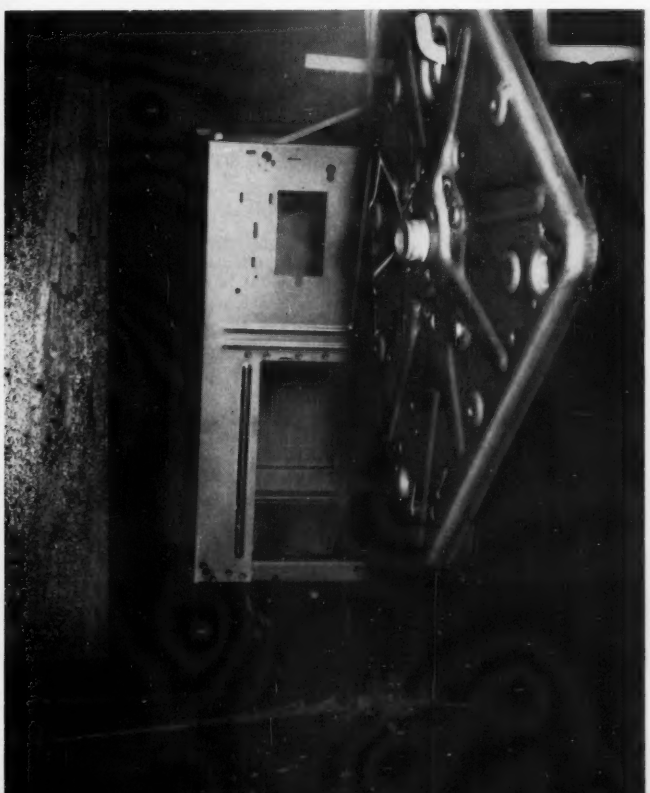


Fig. 2. Following the seven-stage surface preparation, the work enters this booth, where it is flow-coated with an oxidizing primer.

Fig. 3. Where any defects are found in the primary coat after baking they are removed as the work passes through this touch-up sanding area.

degrees F., is maintained with Hysol 102 and Zylol. These additives tend to reduce "orange peel" pattern in the finished surface. Mixing is done in an adjacent tank room, where suitable checks on viscosity are made.

The enamel is pumped at a fixed rate to a central pipe feeding each disc. As the fluid bubbles through the disc center, it is forced out centrifugally by the speed of the disc, and leaves in a fine spray. In Fig. 4 is a view inside one of the booths, with the disc and its pedestal seen between two washing machine cabinets. The disc is shown in a plane near the top of the cabinets.

Feeding rate is adjusted to yield a coat thickness of 2 mils. A single finishing coat suffices. Subsequently, the work is baked in a gas-fired oven for eighteen minutes at 280 to 310 degrees F. A finish of fine appearance and excellent durability results.

All air entering the booths is filtered and heated to 85 to 90 degrees F. Air change is continuous, but, as there is practically no overspray, the exhaust contains only the fumes of the solvent. Walls and floors retain the cleanliness shown in the illustration. Except for one man supervising the operation, no manual labor is required.

Outside the spray room are Ransburg units that maintain the potential required for charging the paint particles as they leave the discs. One of these units is connected by cable to each disc. Since the discs are the only charged metal elements within the booths and do not come close to any grounded surface, there is little danger of any arcing that might ignite vapor.

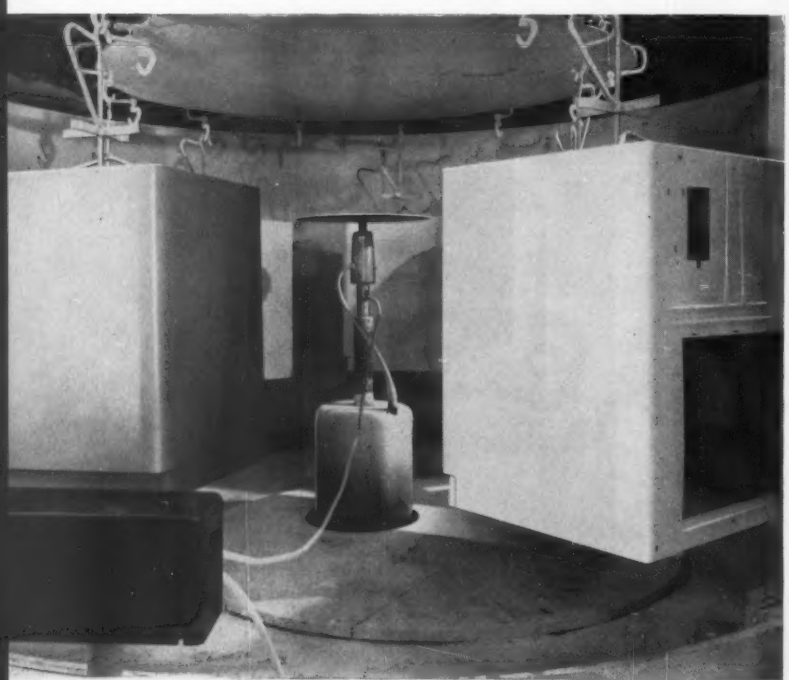


Fig. 4. In addition to spinning, the disc that feeds the paint is moved up and down by hydraulic means so that the entire work area will be coated with enamel.

Fundamentals of Electrical Discharge Machining

ELECTRICAL circuits required and the feed regulation necessary for electrical discharge machining, as well as the productivity, surface finishes, and hardening action obtained with this method, were described in the first installment of this article, published in the May, 1956, issue of MACHINERY, page 139. In this second and concluding installment, factors affecting the precision of machining, materials used for tools, methods of increasing production, and techniques employed in drilling will be discussed.

As the tool and part are brought together, metal particles are pulled from the leading surface of the tool and that surface of the work directly below the tool, as seen at *a* in Fig. 9. With continued downward feed of the tool into the work-piece, discharges occur from the sides as well as the tip of the tool, as illustrated at *b* and *c*. Metal particles removed from tool and work-piece produce secondary discharges which enlarge the hole. Removal of the tool material changes the profile of the tool, and, consequently, the hole produced in the work has a shape different from that required, as shown at *d*. This can be corrected by continuing the feed until the tool is beyond the back face of the work-piece—a distance equal to 1.5 to 2 times the work thickness, as seen at *e*.

Stability of the gap between tool and work depends on the voltage variation at the start of the discharge and the applied voltage. Voltage variation at the start of discharge, corresponding to the gap between electrodes, depends on the sensitiveness of the feed regulator. As the depth of machining increases, concentration of the particles removed also increases, thus creating variations in the gap even when the most precise feed regulator is used. All these factors influence the gap stability and, consequently, the precision obtained in machining. Also, precision is affected by defects in the tool, the design of the machine, and the method of setting up the tool.

Table 5 gives some indication of the variations in hole sizes and gap dimensions when drilling eight holes under the same conditions. These results were obtained in drilling hardened steel 0.194 inch thick with a brass tool 0.390 inch in diameter. Average electrical characteristics were 11.5 amperes, 240 volts, and 100 microfarads. As can be seen, hole sizes at the entry ends vary from plus 0.001 to minus 0.001 inch of the 0.415 inch average diameter. Also, the holes are tapered, having diameters ranging from plus 0.0015 to minus 0.0015 inch of the average 0.409-inch di-

Table 5. Variations in Hole Size and Gap Dimension When Drilling Eight Holes Under Similar Conditions

Hole Number	Diameter of Hole, Inch		Gap between Work and Tool, Inch	
	At Entry End	At Exit End	At Entry End	At Exit End
1	0.414	0.408	0.021	0.015
2	0.414	0.409	0.021	0.016
3	0.414	0.409	0.021	0.016
4	0.415	0.411	0.022	0.018
5	0.415	0.411	0.022	0.018
6	0.415	0.408	0.021	0.015
7	0.416	0.409	0.022	0.016
8	0.414	0.410	0.021	0.017

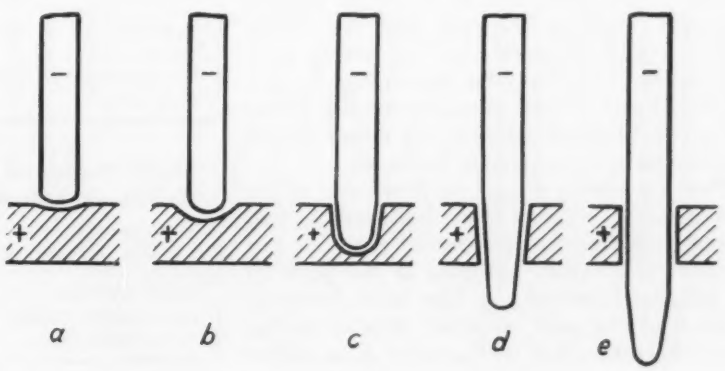


Fig. 9. Leading end of negatively charged tool becomes tapered, due to wear, as it progresses through work. Feed is continued as seen at (e) in order to provide straight hole.

Table 6. Angle of Taper Formed in Electrical Discharge Machining

Operation	Angle of Taper Formed	
	Degrees	Minutes
Rough Machining	1	30
Semifinish Machining	1	..
Finish Machining	..	35

ameter at the exit ends. The angle of taper of through holes produced in this way may vary from a few minutes to a few degrees. This is illustrated in Table 6, which shows the taper obtained when drilling hardened steel with a brass alloy tool containing 40 per cent zinc.

With the same tool and work-piece material, the rate of metal removal increases as the average value of the gap increases. Table 7 shows the value of the lateral gaps when roughing, semifinishing, and finishing steel with a brass alloy tool containing 40 per cent zinc.

All other conditions being equal, the value of the gap depends largely on the chemical analysis of the tool and work-piece. Table 8 gives the variation in gaps when machining hardened steel with tools of different materials. Operating conditions for these results were 120 volts, 4 amperes, and a capacitance of 50 microfarads. The influence of work material on the gap is much greater, as shown in Table 9. For example, in finish machining two different steels with a brass tool, the difference in gap can be 0.001 inch. Therefore, the same size tools cannot be used for finish machining different metals. Tests should be made on samples of the same metal as the work-piece to determine the exact size of the tool. Since gap dimensions do not depend on the size of the holes to be machined, comparatively closer tolerances can be maintained on larger holes.

Electrical discharge machining of abrupt peaks and valleys having sharp angles is difficult, as all angular surfaces will become rounded with this process. In attempting to machine a depression to a sharp root angle, seen at the left in Fig. 10, discharges between the tool and the larger surface area of the work cause the tool to wear more rapidly. Experience has shown that the root radius R of such a depression does not depend on the material being machined, but rather on the type of operation, as given in Table 10.

When machining a peak, as illustrated at the right in Fig. 10, the root of the hollowed-out tool becomes filled with the removed particles and rounded. This causes rounding of the peak on the machined surface. In this case, however, radius R of the peak does not depend on the type of operation, but on the angle A, as shown in Table 11. This radius can be reduced by periodically cleaning the hollow in the tool during machining to remove accumulated metallic particles. Values given in Tables 10 and 11 were obtained when machining hardened steel with a brass tool.

In most cases, the amount that the machined surfaces will be out of shape, as well as the gap dimensions, will be reduced when less power is applied. When precision is essential, spark machining should be performed in two or three operations, such as roughing, semifinishing, and finishing steps. In this way, any errors introduced during roughing can be corrected in subsequent operations.

Tool Materials

Since the principal function of the tool in spark machining is to direct the discharges to the specified area of the work, qualities of the tool are primarily determined by the thermal and electrical conductivity characteristics of the material from which it is made. In principle, any conductive material could be used to make a tool. However, experience has shown that certain metals are superior from the standpoint of productivity and resistance to erosion.

As has been noted, the tool, as well as the work-piece, is worn away during electrical discharge machining by the heat of the operation

Table 7. Lateral Gaps Formed in Spark Machining with Identical Tools

Operation	Lateral Gap, Inch
Rough Machining	0.020 to 0.024
Semifinish Machining	0.008 to 0.012
Finish Machining	0.001 to 0.002

Table 8. Lateral Gaps Formed in Spark Machining with Different Tools

Tool Material	Lateral Gap, Inch
Brass with 37 to 40 Per Cent Zinc	0.010
Copper	0.011
Graphite-copper Mixture	0.012
Gray Iron	0.013

Table 9. Lateral Gaps Formed in Spark Machining Various Steels with Brass Tool

Operation	Lateral Gap, Inch
Rough Machining	0.005 to 0.007
Semifinish Machining	0.004 to 0.005
Finish Machining	0.002 to 0.003

Table 10. Variation in Root Radius (R) of a Depression in Work (Left in Fig. 10) for Different Electrical Discharge Machining Operations

Operation	Angle (A), in Degrees, as Seen at Left in Fig. 10						
	15	30	40	60	75	90	105
	Root Radius (R) of Depression in Work						
Rough Machining	0.012	0.012	0.016	0.016	0.012	0.016	0.015
Semifinish Machining	0.010	0.008	0.012	0.012	0.012	0.016	0.011
Finish Machining	0.002	0.004	0.004	0.002	0.002	0.004	0.003

and the friction of the metal particles in the fluid. Wear of the tool can vary between 20 and 250 per cent of the volume of metal removed from the work, depending on the machining conditions and the materials from which the workpiece and tool are made. In practice, tool wear can be reduced by varying the discharge circuit resistance, lowering the power input, selecting a more erosion-resistant material, or altering the shape of the tool. Cost, machinability, and strength of the tool material must also be considered in attempting to find one providing maximum stock removal with minimum wear.

Tools made from a copper-graphite mixture, or brass containing 40 per cent zinc, provide the best productivity, as illustrated in Fig. 6, presented in the first installment of this article (May, MACHINERY, page 143). Sometimes, gray iron tools are recommended. Considering the wear resistance of brass containing 40 per cent zinc as the unit, the relative resistance to wear of other tool materials is given in Table 12.

In using brass tools, less wear is observed when the brass contains no zinc. However, the productivity obtained with brass tools is best when the material contains about 39 per cent zinc. For these reasons, brass tools cannot fulfill the two most important conditions—maximum productivity with minimum wear.

From Table 12 and Fig. 6, it is evident that the best material for tools, from the standpoint of high productivity and low wear, is a graphite-copper mixture. Such tools can be made by mixing powdered copper and graphite, subjecting the mixture to very high pressure, and sintering. However, the use of such tools is limited by the fact that they are difficult and costly to make. Also, the mechanical properties of this material are low.

The mechanical properties can be improved by adhering to the following technique. A powder mixture containing 85 per cent copper, 2.5 per cent aluminum, 2.5 per cent graphite, and 10 per cent sintering agent is first thoroughly mixed, and then water is added to produce a paste. This paste is placed in a mold and compressed with a pressure of 14,000 to 21,000 pounds per square inch. During compression, water is expelled from the mixture, and the volume is reduced about 2 1/2 times. Surfaces of the tool thus produced have a mirror finish, and hardness of the material is excellent.

Because tools of other materials are simpler and cheaper to make, they are often used instead of the graphite-copper type, even though such tools have less erosion resistance and lower productivity. Perhaps the best of such substitute materials is red brass. However, a relatively new

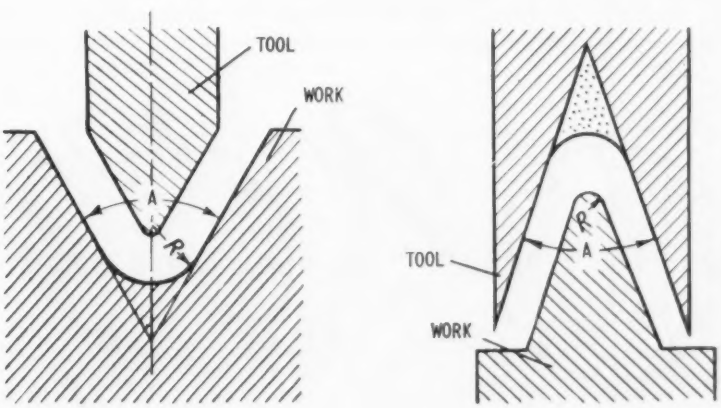


Fig. 10. Angular surfaces will become rounded in attempting to produce abrupt peaks or valleys by the electrical discharge machining method. Radii (R) are given in Tables 10 and 11.

Table 11. Variation in Peak Radius (R) on Work (Right in Fig. 10) for Different Angles (A)

Operation	Angle (A), in Degrees, as Seen at Right in Fig. 10				
	15	30	45	60	90
	Peak Radius (R) on Work				
Rough Machining	0.008	0.012	0.016	0.024	0.043
Semifinish Machining	0.010	0.012	0.020	0.024	0.039
Finish Machining	0.010	0.010	0.016	0.024	0.043

Table 12. Relative Wear Resistance of Various Electrical Discharge Machining Tools

Tool Material	Relative Resistance to Wear
Bronze	1.19
Brass with 5 Per Cent Zinc	0.84
Phosphor Bronze	0.69
Gray Iron	0.38
Copper	0.37
Graphite-copper Mixture	0.30

alloy containing 96 to 97 per cent copper and 3 to 4 per cent cadmium permits an increase in productivity of from 20 to 30 per cent with about one-fourth the wear.

High productivity and minimum wear are not always the determining factors in selecting the tool material. For example, in machining complicated surfaces such as dies, a primary consideration is the cost of producing the complex shape tool. In such cases, tools formed by pressing or casting will usually cost less than machined tools. For this reason, cast-iron or aluminum tools are often preferred. Table 13 shows different methods employed in making tools from various materials.

Tool Design

Since the opening produced in the work-piece surface is always larger than the tool used in electrical discharge machining, the tool dimensions must always be smaller than those specified on the part drawing. Table 14 gives some typical reductions in tool size when machining carbon steel with a copper-graphite or brass tool.

The length of the tool working surface must also be considered to compensate for linear wear and to correct for the unavoidable taper produced. This length for through holes 1/8 inch or more in diameter should be from 1 1/2 to 2 times the hole depth. For holes less than 1/8 inch in diameter, the working length of the tool should be from 4 1/2 to 7 1/2 times the hole depth.

All tools for electrical discharge machining can be divided into two major classifications: sectional profile or complete profile, as shown at *a* and *b*, respectively, in Fig. 11. Each classification can be subdivided into hollow or solid tools, Fig. 12. Tools can be grouped according to operation into those having inclined hollow passages (left in Fig. 13), serrated types (center), or backed-up types (right).

Partial profile tools are used for large surfaces for which solid tools would be too expensive or difficult to make. Complete profile tools are better for less complicated surfaces in which a high degree of precision is required. Inclined hollow passages are often provided in the tools to facilitate the evacuation of gases and particles of metal. Serrated tools are sometimes desirable for blind or deep holes. Backed-up type tools are used for through holes and blind holes when their cross-sectional area is greater than 0.0465 square inch. This type tool requires less energy, and, since the fluid circulates freely, efficiency is increased.

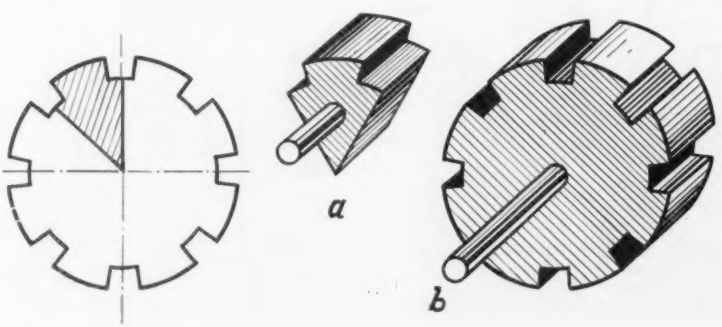


Fig. 11. To produce an opening such as the one seen at the left by electrical discharge machining, sectional or profile tools as shown at (a) and (b) can be employed.

Table 13. Methods of Manufacturing Various Electrical Discharge Machining Tools

Method of Manufacture	Tool Material					
	Graphite-Copper Mixture	Brass with 40 to 50 Per Cent Zinc	Copper-Cadmium Alloy	Copper	Gun Metal	Aluminum
Casting		√	√	√	√	√
Forging		√	√	√		√
Machining	√	√	√	√	√	√
Forming and Welding		√	√	√	√	√
Pressed and Sintered	√					

The special tool seen at the left in Fig. 14 was made by forming and welding a strip of sheet metal, and was used to cut the scalloped design illustrated at the right. Thickness of the sheet must be uniform to eliminate irregular wear during machining. Brass sheets to be made into tools should be annealed to minimize distortion during machining.

Table 14. Recommended Reduction in Lateral Tool Size for Electrical Discharge Machining

Operation	Lateral Reduction in Tool Size, Inch
Rough Machining	0.020 to 0.039
Semifinish Machining	0.008 to 0.020
Finish Machining	0.002

Methods of Increasing Productivity

At the present time, electrical discharge machining of common steel is much less productive than more conventional mechanical methods. Maximum stock removal in steel is about 0.020 cubic inch per minute. This is primarily due to the fact that about 99.3 per cent of the cycle time is required for charging and discharging of the condensers, allowing only 0.7 per cent for actual work. Productivity will be greater when the time required between discharges is decreased.

Condenser plate voltage increases very rapidly at first, and reaches 0.9 times the value of the applied voltage during the first half of the charge. Discharge should take place at this point, even though the energy is about 19 per cent lower than it would be at full capacity. In discharging at this point, charging time is reduced, and more discharges can be produced per minute—thus increasing the productivity.

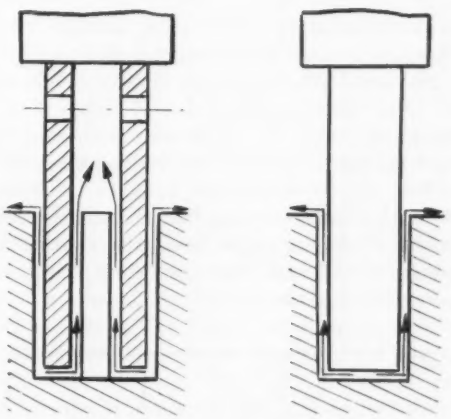


Fig. 12. Hollow tools, such as the one seen at the left, permit more rapid production than can be obtained with solid tool (right) because less metal has to be removed.

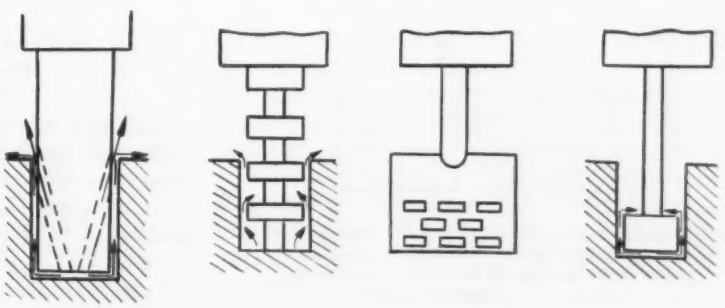


Fig. 13. Inclined passages in tool at left facilitate evacuation of gases and metal particles. Two tools in center are good for deep holes. Tool at right is useful for blind holes.

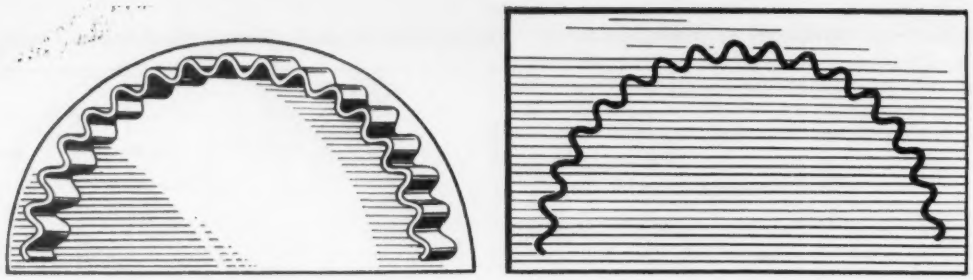


Fig. 14. Scalloped design in work-piece seen at right was produced by electrical discharge machining method with tool (left) made by forming and welding sheet metal.

In practice, forced discharge is obtained by bringing the electrodes together to obtain the required gap distance. Setting of the feed regulator to obtain this condition can be checked by reading the voltmeter of the discharge circuit. When the distance between electrodes is most favorable, discharge voltage will reach from 0.7 to 0.85 the value of the charging circuit voltage.

During machining, discharges succeed each other without any parallel discharges. Productivity could be increased considerably if several discharges could occur simultaneously. This could be accomplished by substituting multiple circuit wiring and a composite tool, as shown in Fig. 15, for the usual single wiring circuit. Each electrode of the composite tool would be wired to the cathode of a separate condenser, with each condenser charged through an individual resistor. The tool electrodes would have to be isolated from each other by wrapping them with several layers of insulating paper having a total thickness of about 0.0085 inch. This insulation would burn away as the tool wears.

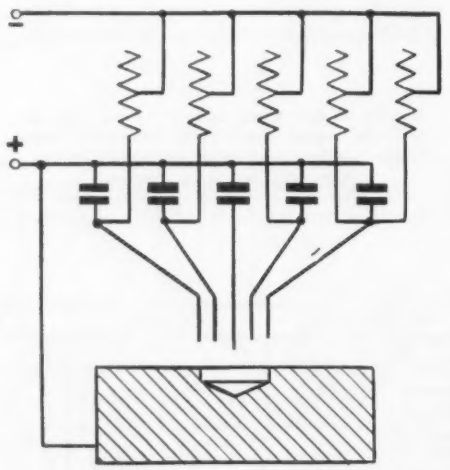


Fig. 15. High productivity can be obtained by using multiple circuit wiring and a composite tool. Each electrode of the tool is wired to the cathode of a separate condenser.

One of the simplest methods of increasing productivity is to place an inductance coil, having an iron core, in the charging circuit, as shown in Fig. 16. The increased inductance permits faster metal removal by raising the voltage at the beginning of the discharge.

Hollow tools also increase productivity by reducing the amount of metal to be pulverized and facilitating the removal of metal particles. As the depth of hole increases, however, evacuation of particles becomes more difficult. The increased concentration of particles in the gap lowers the productivity considerably in such cases, even when a hollow tool is used. This can be overcome to some extent by adapting a nipple to the hollow tool, as seen in Fig. 17, and pumping the fluid through the nipple and tool under pressure. Such forced circulation is useful only when the depth of machining exceeds 1.5 to 2 times the hole diameter. When a hollow tool cannot be used for deep-hole drilling, it is sometimes advantageous to oscillate the tool.

Table 15. Recommended Maximum Power for Different Size Holes

Cross-Sectional Area of Hole, Square Inches	Maximum Power, K.W.
0.0015 to 0.031	0.8 to 1
0.031 to 0.310	1.5 to 2
0.310 to 2.480	2 to 4.4

Drilling with the Electrical Discharge Method

Drilling is one of the most common operations performed by the electrical discharge method. Even though productivity is low, this method has the advantage of being suitable for any metal, regardless of hardness. Also, rotation of the work-piece or tool is not required. For these reasons, the process is frequently desirable for producing

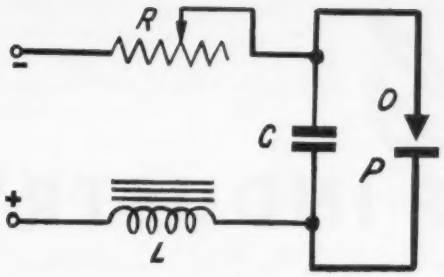


Fig. 16. Inductance coil (L) placed in charging circuit will increase productivity by raising the voltage at the beginning of discharge and permitting faster metal removal.

cylindrical or other shape holes in hard metals, and for drilling very small holes. Another advantage is that curved holes can be machined by using a curved tool, and providing special means of feeding the tool in the required arc.

Excessive gas formation in the working zone will force away the liquid and cause interruption of the machining process. For this reason, the power must be limited according to the size hole being produced. Recommended power for different size holes is given in Table 15.

Drilling of holes smaller than 0.020 inch in diameter with regular tooling is difficult because of the lack of tool rigidity. For such operations, a special bushing is usually employed. A suitable bushing can be made by heating a glass tube until its bore is the required size and then setting the tube in a non-magnetic plate which is placed about 0.023 inch from the work surface. Since evacuation of metal particles is generally a problem, the tool or work-piece should oscillate axially. Tools for small-hole drilling are generally made from tungsten or brass wire that is straightened by heating and drawing and provided with tapered ends. For drilling such small holes to close tolerances with a minimum of tool wear, the operation should be performed with low power, as indicated in Table 16 below.

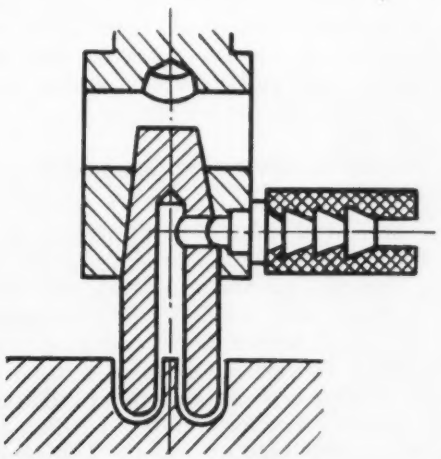


Fig. 17. When depth of machining exceeds 1.5 to 2 times the hole diameter, removal of metal particles can be facilitated by pumping fluid through hollow tool.

Table 16. Electrical Characteristics for Precision Drilling of Small Holes with Minimum Tool Wear

Diameter of Hole, Inch	Voltage, Volts	Capacitance, Microfarads	Current, Amperes
0.004	25 to 40	0.15 to 0.5	0.1 to 0.5
0.008	40 to 70	0.5 to 2	0.2 to 0.75
0.012	40 to 100	0.5 to 4	0.3 to 1.0
0.016	75 to 100	1 to 5	0.4 to 1.2
0.020	75 to 125	2 to 8	0.5 to 1.5

* * *

Lathe Attachment for Cutting Nonlinear-Pitch Screws

The National Bureau of Standards has been using a simple lathe attachment for cutting screw threads with a nonlinear pitch. The device consists essentially of a vertically moving cam-plate that bears against the tool-holder carriage on the lathe, and thus moves the carriage horizontally.

The nonlinear screw-cutting device can be attached to a standard lathe. The lathe is not altered in any way, although it is often desirable to remove the apron before the attachment is locked rigidly to the bed. The attachment contains a sliding cam-plate, constrained to move only in a vertical direction. It is driven up and down by engaging a rack to a pinion gear that is keyed to the lead-screw of the lathe.

The cam contour, cut on the side of the cam-plate, moves upward at a constant rate, bears against the tool-holder carriage, and displaces the carriage sideways. The nonlinear motion of the carriage is controlled by the contour of the cam. In producing the cam, the required horizontal and vertical coordinates (appropriately scaled to the dimension of the cam) are plotted directly on the cam blank.

If a straight, pivoted bar is used in place of the cam in this attachment, it becomes another useful laboratory tool. By adjusting the slope of the bar and clamping it in place at the appropriate angle, it becomes a cam surface that permits the cutting of any nonstandard linear screw thread for which gear ratios in the lathe are not available.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Carbide for Milling High Tensile Strength Cast Irons

A milling grade carbide for milling high tensile strength cast irons has been announced by the Carboloy Department of General Electric Co., Detroit 32, Mich. Designated Grade 860, this carbide provides a strong cutting edge that is resistant to chip-outs or cratering. It is especially adapted for milling the newer types of gray cast irons which include additives to provide denser structures. Such cast irons are in the hardness range from 223 to 248 Brinell. Grade 860 carbide is especially adapted for face-milling operations but may also be used for plain milling or slotting operations. It performs well in the automotive field where heavy scale and interruptions are encountered. Per-tooth feeds of from 0.007 inch to 0.012 inch at speeds between 250 and 300 feet per minute are recommended.

Polishing Aid for Abrasive-Belt Operations

A belt grease, developed by the Kocour Co., 4800 S. St. Louis Ave., Chicago 32, Ill., can be used as a polishing aid for abrasive-belt operation on both ferrous and non-ferrous metals. It is called "Kocour Belt Grease" and has non-loading properties that maintain a film on the abrasive surface, preventing metal particles from adhering to the cutting points of the surface. The grease does not clog the belt. It is available in paper tubes, 2 1/2 by 8 1/2 inches. Each tube weighs approximately 1 1/4 pounds.

Asbestos Fabric Developed for Power Transmission Equipment

Designers and users of oil-cooled power transmission equipment, such as clutches, torque converters, power take-offs, steering clutches, and brakes, are now being offered a series of friction materials of woven asbestos fiber impregnated with various oils and resins by the Friction Division of the Thermoid Co., Trenton, N. J. The material, called "ATR Series Woven," contains no metallic particles or wires, is light and inexpensive, and is available in ring, band, or core form.

The material has been designed for bonding to metal plates using thermosetting resins. In one application, these plates are assembled in oil-cooled units alternately with metal pressure plates. The friction material can be furnished cut to the required size or bonded to the plates where large-volume production quantities are needed. Thicknesses of the material range from 0.030 inch to 0.090 inch, increasing in increments of 0.010 inch. One-piece, full-ring diameters are available up to 12 inches outside diameter.

Paint Adhesion Assured on Various Smooth Surfaces

The adhesion of paint films to smooth surfaces, such as galvanized sidings, aluminum sheets, and painted signs, has been facilitated by the use of "Totrust Metal-Bond (clear)," a product of the Wilbur & Williams Co., 130 Lincoln St., Brighton, Mass. This product is a clear metal coating which can be applied by brush or spray. When dry, it acts as an adhesive for the usual types of paints and also as protective coating for these surfaces. Surfaces to be coated must be dry and free of grease, oil, and loose particles. This material can be used on bare wood, plastics, wallboards, and cement-asbestos boards.

Four Additional Polystyrene Compounds Now Available

Four additional polystyrene compounds have been added to the Styron line of plastics by the Dow Chemical Co., Midland, Mich. The first, called "Styron 440," combines heat resistance, impact strength, surface finish, and good moldability. These properties can be used to advantage by molders of such products as radio cabinets; calculator housings; cutlery handles; and automotive, refrigeration, and photographic parts.

The second, "Styron 429," gives good surface finish and gloss to sheet products. Its increased flexural strength should prove advantageous for

the economical vacuum forming of products from thin extruded sheet.

The third, "Styron 665," is a general-purpose polystyrene developed for the extrusion process. It offers increased resistance to shattering or cracking when being cut and has a relatively high heat-distortion temperature. Uses indicated include general shape extrusions, bristles, and thin film applications.

The fourth, "Styron 689," has been developed to meet the requirements for molding thin sections; deep draws; and parts requiring accurate dimensional control, such as packages, vials, and housewares items. This compound is well suited for high-speed automatic molding operations on large-area parts.

Bright Nickel-Plating Process with High Leveling and Speed

A new high-speed bright nickel-plating process called "Levelume" has been announced by the Hanson-Van Winkle-Munning Co., Matawan, N. J. This process combines the qualities of "full" brightness, high leveling, and exceptional speed. Newly developed addition agents make it possible to use an activated carbon pack in the filter for the plating solution. This continuously removes harmful organic contaminants, doing away with the time-consuming periodic batch purification which may otherwise be necessary.

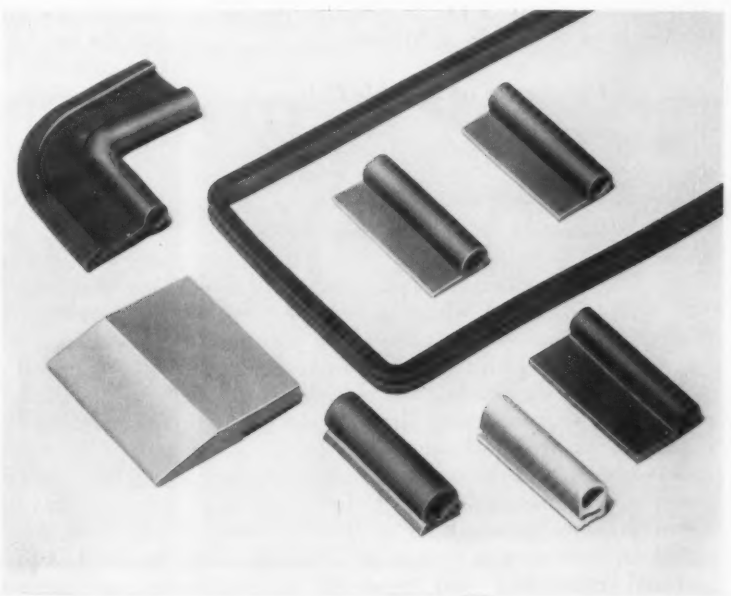
The high leveling characteristics enable the deposit to fill in scratches to a degree which, in many cases, eliminates polishing and buffing for extra smoothness after plating. Objects can be double coated if higher corrosion protection with a given nickel thickness is desired. The bath is stable in operation, and plating temperatures range from 145 degrees F. to 160 degrees F., with 145 degrees F. normal for plating zinc die-castings and 160 degrees F. normal for steel.

Silicone Rubber Compounds with High Tensile and Tear Strengths

Two silicone rubber compounds for molded and extruded parts, with relatively high tensile and tear strengths, have been developed by the Connecticut Hard Rubber Co., 407 East St., New Haven, Conn. Known as "Cohrlastic HT 655" and "Cohrlastic HT 666," these compounds possess the basically desirable characteristics of silicone rubber, namely, the immunity to ozone deterioration, flexibility at high and low temperatures, and a non-adhesive surface. Both materials are being used in the aircraft industry for external seals.

The tear strength of Cohrlastic HT 655 is 197 pounds per inch at room temperature and 100 pounds per inch at 400 degrees F. Its tensile strength at room temperature is 1650 pounds per square inch and at 400 degrees F., 665 pounds per square inch. It has an elongation of 900 per cent at room temperature and 390 per cent at 400 degrees F. This compound is a methyl base material designed for high temperature work. It will remain flexible at −65 degrees F.

Cohrlastic HT 666 is a methyl-phenyl base material having a tear strength equal to or better than that of HT 655 and slightly less tensile strength and elongation. It is highly flexible at −100 degrees F.



These molded and extruded Cohrlastic HT silicone rubber seals feature the properties of good tear and abrasion resistance, in addition to the other basically desirable properties of silicone rubbers.

Know Your Cutting Fluids

Second and concluding installment of an article explaining the action and role of the modern cutting fluid

By R. K. GOULD and R. C. GIVENS
Research and Technical Department
The Texas Company, New York City

IN ORDER for a liquid to be most effective as a coolant, it should have high specific heat, high thermal conductivity, and high heat of vaporization. Mineral oils are not among the best fluids in these respects—so are not particularly effective in removing heat once it is formed. Actually, water is about the most efficient cooling medium known. However, there are numerous reasons why straight water cannot be employed as a cutting fluid. Probably the most obvious one, as well as the most important, is its rust-promoting characteristic. Also, it has little value as a lubricant.

Through the use of soluble oils, additional properties can be imparted to water. These oils are compounded to form a stable emulsion when mixed with water. Since water is the major component of the emulsions as they are normally used, it can still function efficiently as the coolant. However, the mineral oil and the additives contained therein impart desirable lubricating, anti-friction, and anti-corrosion properties to the emulsion. Different combinations of cooling and lubricating properties can be obtained by varying the ratio of soluble oil to water.

Properties of Soluble Oils

Soluble oils are not really "soluble," since they do not form a true solution when mixed with water. As mentioned before, they form an emulsion, and actually should be termed "emulsifiable" oils.

An emulsion contains two separate and distinct liquid phases, one of which is dispersed in the other. The liquid which is broken up into globules is known as the dispersed, or internal, phase; and the liquid surrounding the globules is called the continuous, or external phase. In the soluble-oil emulsions used for machining, the oil is the internal phase and the water the external phase.

For two non-soluble liquids to form a homogenous mixture, or emulsion, a third substance called an emulsifier is necessary. This will be a material containing two types of molecular groups, one of which will orient in the water phase and the other in the oil phase. Consequently, it will be adsorbed at the common boundary of the two liquids and make the transition between them less abrupt.

In a sense, an emulsifier might be regarded as a bridge connecting two dissimilar liquids. By being adsorbed at the common boundary, the emulsifier serves to decrease the interfacial tension and permits increased sub-division of one liquid in the other. In addition, it provides a film surrounding each particle of the dispersed phase, and mechanically prevents them from coalescing with each other. Thus, in picturing a soluble-oil emulsion, one might visualize a drop of oil enclosed in a film of emulsifier which, in turn, is surrounded by water.

The main requirement of a soluble oil is that it emulsify readily with water to form a stable emulsion. This will be a function of the oil, the emulsifiers, and the water used. Emulsions of two different soluble oils prepared at the same time can be seen in Fig. 7. After standing a few months, the emulsion on the left is still stable, but the one on the right has separated. In addition to being stable, soluble oils should contain ingredients to combat a particular undesirable condition that might be encountered in service.

Rust Protection

Next to having good emulsification properties, the rust-protection characteristics of the emulsion are probably the most important. Rusting of machined parts is highly undesirable, since rust removal is both expensive and time-consuming. All soluble-oil emulsions afford some protection against rust formation, if only by virtue of the oil present. Also, some of the emulsifiers used are rather good rust inhibitors in themselves. Products offering only borderline protection against rust can be employed in operations where rich emulsions (high ratio of oil to water) can be used or where the metals being machined are not particularly prone to rust. However, in

many cases the rust protection of these products is quite inadequate. This is particularly true in grinding cast iron. For such operations, soluble oils are available containing rust inhibitors which are effective even at high dilutions.

Detergency

Frequently, in grinding operations, there is a tendency for the wheel to load rapidly and for the machine to become unusually dirty. This is especially noticeable when using a fine-grit wheel to remove a small amount of stock. The emulsion wets the portion of the machine with which it comes in contact, and, as the water evaporates, an oily film is left behind. This film—acting very much like flypaper—holds the fine bits of grinding dirt along with any dust particles that may be in the air. The result is a very dirty machine. Such conditions can be improved by using soluble oils having increased detergency properties.

Most emulsifiers are of the surface-active type and have good washing characteristics. Thus, in some cases, improved detergency is imparted to the oil by using an additional quantity of the emulsifier. In other cases, another material entirely may be incorporated in the oil by the manufacturer.

Dirt Settling Characteristics

Where emulsions are supplied to individual machines from a central system, it is important that the emulsions keep the grinding dirt in suspension and prevent it from dropping out in the return lines. Obviously, if sufficient dirt settles, the lines soon become clogged. On the other hand, where each machine is supplied from its own reservoir, it is essential that the grinding dirt settle rapidly so that it will not be recirculated. Thus, depending upon the particular situation involved, the emulsion should either settle dirt quickly or should suspend it. Fortunately, either one of these characteristics can be built into a soluble oil, and it is important that the user select one that will satisfy his requirements in this regard.

Hard Water

The water used to prepare a soluble-oil emulsion will have a pronounced effect on its stability. Actually, for best results distilled water or steam condensate should be employed. But this is impractical, since the emulsion must be made with the water available, and varies in characteristics from plant to plant. The water may come from a lake or river and be exceptionally soft, or it may emanate from a deep well and be extremely hard.

Hard water is detrimental to the emulsification properties of most soluble oils. Components contributing to the hardness, such as calcium and magnesium, can react with the emulsifier and produce insoluble materials which will separate and form a scum on the surface of the emulsion. The portion of the emulsifier involved cannot perform its intended function, so the remaining emulsifier becomes inadequate. In addition, salts present in hard water tend to be adsorbed in the critical zone between the oil and water, and cause an increase in tension. Thus, in effect, the combination of the depletion of the emulsifier and the adsorption of the salts weakens the bridge holding the oil and water together, and makes the emulsion less stable.

Soluble oils are available which have been compounded to form stable emulsions with hard

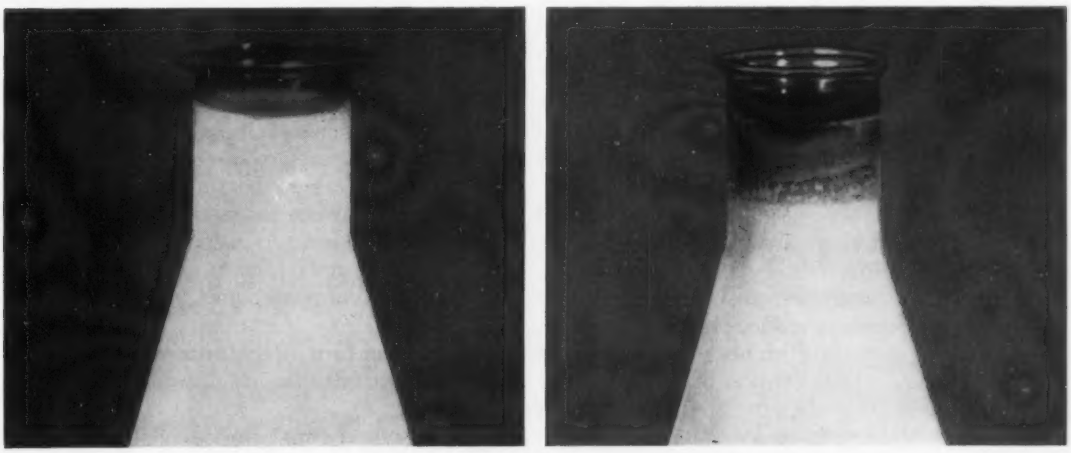


Fig. 7. Both emulsions were prepared at the same time, but the one at the left proved to have a higher degree of stability.

Fig. 8. The soluble oil in the beaker on the left produced an unstable emulsion because of the hardness of the water.

water, and they should be used when needed. It is generally accepted that these hard-water soluble oils can be used to advantage when the water hardness is over 300 parts per million. Illustrated in Fig. 8 are two emulsions prepared from water of 600 parts per million hardness. The emulsion on the left is unstable, and unsuitable for use with hard water. The one on the right is satisfactory.

Protection Against Bacteria

Soluble oils are sterile when prepared and delivered to the customer. However, bacteria can be introduced in an emulsion either through the water used or through contamination of the emulsion in service. If permitted to propagate unabated, they can create some undesirable conditions. Bacteria are responsible for unpleasant "Monday morning" odor. They can also promote rusting, and cause an emulsion to break. Usually, a soluble oil contains a germicide which affords some measure of protection against bacterial growth.

Extreme-Pressure Properties

The main difference between the action of soluble-oil emulsions and cutting oils in machining has already been considered. It was pointed out that the emulsions are essentially coolants, whereas the cutting oils, by virtue of their extreme-pressure and wetting properties, act mainly as lubricants to reduce friction. However, there are an increasing number of soluble oils available today which contain extreme-pressure characteristics. They are generally referred to as heavy-duty soluble oils, and emulsions prepared from them combine good cooling capacity with anti-friction properties. In fact, these oils can do all but the most difficult jobs which formerly could be handled only by cutting oils.

All in all, soluble oils are among the most complex products of the lubricant manufacturer. Probably no other petroleum product demands such a delicate balance of ingredients, and the more ingredients present, the more sensitive and delicate is the balance.

Conventional soluble oils contain mineral oil as the major constituent and, when mixed with water, form a milky or opaque emulsion. Newer products, now available, form either a translucent emulsion or a transparent solution when mixed with water. The former can be classified as special soluble oils, since they do contain various amounts of mineral oils. The translucency of the emulsion is due to a large concentration of the emulsifier base incorporated in the product.

Products which form true solutions with water contain no oil and are termed synthetic, or chemical, coolants. They may contain as much as 80 per cent water, plus certain chemicals to impart rust protection, detergency, and penetration characteristics. Lubricating properties of these coolants generally are quite inferior to those of the conventional emulsions. Also, over a period of time, hard chemical deposits may accumulate on the machine parts, so care should be exercised in using them where bearings, tool-slides, and other such areas are exposed. Products of both the transparent and translucent type are employed to best advantage in fine-grit, low stock-removal grinding operations.

Practical Considerations on the Care and Handling of Soluble Oils

Soluble oils are not prima donna products, but do require a certain amount of attention in handling and application for optimum performance.

Table 1. Precautions in Handling Soluble Oils

1. Avoid Overheating or Excessive Aeration Overheating or excessive air mixing may upset the water and solvent balance, causing instability. In addition, heating may speed up changes in acidity which could hurt stability.
2. Avoid Contamination Contamination with water should be avoided. Soluble oils from various supplies should not be blended or mixed. Contamination of soluble oils with mineral oils may also have adverse effects.
3. Protect from Extended Periods of Freezing and Thawing Soluble oils are not particularly sensitive to low-temperature changes and generally may be frozen without serious deterioration. However, continued intermittent freezing and thawing of the products may upset the balance of the components and create unstable emulsions.

Some basic precautions which should be observed in handling soluble oils prior to emulsification are given in Table 1.

Frequently, users of large quantities of soluble oil store it in bulk underground tanks. There, it is entirely possible for it to become contaminated with water, from either condensation or seepage. Since contamination can destroy the balance of the ingredients in the oil and may make the product unusable, the tanks and the oil in them should be inspected periodically. Analysis of a sample of oil taken from the bottom of the tank will reveal the presence of extraneous water. Usually, the supplier performs this service for the customer.

Preparation of the Emulsion

One of the most important factors influencing the performance and life of an emulsion is the manner in which it is prepared and the nature of the water used. First of all, the equipment used should be clean. This includes not only the vessel in which the emulsion is to be made but also any containers used to transfer the oil and water. At the time of mixing, the oil should be at room temperature. If the temperature is so low that the product is thick and viscous, difficulty may be experienced in emulsification.

Oil should always be added to the water. *Never add water to the oil.* This is perhaps one of the most common mistakes made in connection with the preparation of soluble-oil emulsions. There is always a danger of forming an inverted emulsion, or a water-in-oil type, when the water is added to the oil. This is most undesirable. At least six or seven times as much water as the total amount of oil used should be in the mixing vessel before adding the oil. Also, for the best emulsification, the oil should be added slowly with agitation. This does not mean that it must be added drop by drop, but neither should it all be poured in at once. It is vitally important that agitation be continued until all of the oil is emulsified.

The ease of emulsification will vary from oil to oil. Some will form an emulsion almost spontaneously, while others will require considerable agitation. The nature of the emulsifiers and the type and number of additives have a pronounced effect on the ease with which a soluble oil will emulsify. The important point to remember is that an emulsion in which the oil is only partially emulsified will not give optimum performance and usually will cause trouble.

Many of the troubles encountered with soluble-oil emulsions can be traced directly to the water used, so it is to the best interests of the user to be thoroughly familiar with its properties. In Table 2 is a list of the factors in water which affect its emulsification. As already explained, the hardness components of water actually can remove some of the emulsifiers from a soluble oil. If hard water is to be used, there are two courses that can be followed satisfactorily: (1) use a soluble oil prepared especially for hard-water application; or (2) soften the water. If the second course is chosen, competent advice should be sought as to what to use and how much. Treatment of the water always should be completed before the emulsion is prepared, and should be done in a separate vessel. This will prevent the scum formed in the softening process from contaminating the emulsion.

Care of Emulsions

Even though soluble oils are sterile as delivered and generally contain a bactericide or bacteriostatic agent, the emulsions can support bacterial growth in the water phase. The amount of inhibitor which can be incorporated in the oils cannot protect them completely against all

Table 2. Factors in Water Affecting Emulsification

1. Iron, calcium, and magnesium salts
2. Total solids content
3. pH (acidity or alkalinity)
4. Bacteria or algae content

Table 3. A Procedure for Cleaning Emulsion Systems

1. Drain or pump all of the used emulsion from the system.
2. Disassemble as much of the system as practical and manually remove chips, sludge, or other contaminants from all accessible surfaces.
3. Reassemble equipment and circulate a suitable detergent solution through the system.
4. Drain the detergent solution and circulate an antiseptic or disinfectant solution. Be sure it reaches all surfaces with which the emulsion comes in contact.
5. Drain the disinfectant solution, flush with clean water, and recharge with fresh emulsion.

conditions of pollution which may occur in the field. If allowed to develop unchecked, bacteria will destroy essential ingredients through metabolism. In addition, waste products have a deteriorating effect on the emulsion. In many cases, the odors developed are extremely offensive.

There are many ways in which bacterial contamination of emulsions may occur. Microflora may be present in the water, particularly in untreated or improperly treated river water. They may also come from the worker's hands, the work-pieces, or from refuse cast into the emulsion. Where possible, it is extremely desirable to use water of zero to low bacteria content. This gives the emulsion a good start toward a long life.

The next step in obtaining maximum life and top performance from the emulsion is to be sure that the coolant system is clean and that the equipment and emulsion are maintained as clean as possible during use. A suggested procedure for cleaning systems is given in Table 3.

Even where all rules for the preparation of the emulsion and coolant system have been properly observed, service life cannot be predicted. This will vary appreciably from plant to plant and from machine to machine, depending on mechanical conditions, as well as on the general cleanliness exercised. It is virtually impossible to avoid recontamination of an emulsion and coolant system, but the bad effects can be minimized. This will depend to some extent upon the personal habits of the operator. Soluble-oil systems should not serve as refuse disposals, spittoons, or wash basins.

In instances where the emulsion gets out of hand temporarily, the supplier can usually recommend a remedy. If a germicide is to be added, care should be taken that no adverse effects upon stability and subsequent performance of the emulsion are produced. Furthermore, too much germicide may lead to dermatitis.

In addition to bacterial action, there are other factors which will contribute to poor or shortened life of the emulsion. Frequently, contamination can be traced to the work-pieces, if they bear rust-proofing compounds, brazing fluxes, or cutting oils from other operations. Or, the contaminant may be just plain dirt or rust.

Emulsions have to absorb a certain amount of contamination and abuse for their use to be practical. However, when difficulties arise, a thorough check of the manner in which the emulsions are being handled should be made.

It is a common occurrence for mineral oils from machine leakage to contaminate coolant systems. If this becomes excessive, trouble ensues. The oil blankets the emulsion in the sump and, by excluding air, provides a fertile breeding ground for bacteria. In addition, when mineral oils are intimately mixed with the emulsion during use, such as on recirculation of the emulsion, these oils may actually extract some of the emulsifier and additives in the soluble oil. Under such circumstances, it becomes difficult to determine emulsion strength, since the emulsion appears rich in oil components.

On the other hand, water may be lost from the emulsion. This may entail operational difficulties, especially in grinding applications where chip settling may be adversely affected because of the enrichment. Another eventuality is that the oily component of the emulsion may be absorbed by the chips formed in the operation, particularly in grinding cast iron, so that the emulsions become too lean. Experience has shown that three general safeguards, listed in Table 4, are important in obtaining the longest possible service life from an emulsion.

There have actually been complaints about dirt settling characteristics of emulsions, where, on investigation, it was found that the coolant pump suction level was well below the level of the solids settled in the sump. As a result, a high concentration of solids was recirculated with the

Table 4. General Safeguards for Longer Emulsion Life

1. Keep close check on control of emulsion strength. Be sure the oil content represents effective soluble oil and not oil from contamination or so-called "tramp oil."
2. Eliminate as many sources of contamination as possible.
3. Remove chips, grinding dirt, and other contaminants as quickly and as thoroughly as possible.

emulsion. Obviously, such a condition could and should be avoided.

In addition, it would be extremely desirable in the design of machine tools to incorporate every conceivable feature to aid emulsion preparation, chip removal, and general cleanliness. There are many devices available for cleaning emulsions, such as paper filters, magnetic filters, and flotation devices. Usually, some means can be adapted in the particular shop. In shops where volumes are sufficiently large to warrant saving the emulsions, portable filters are used for cleaning sumps. There are also a number of large central systems which employ various and complicated means of removing solids, and aerating and de-oiling the emulsions. These systems, if kept clean, operate for long periods without emulsion change, the occasional addition of fresh emulsion being all that is necessary.

Selecting the Proper Fluid

The proper selection of a cutting fluid is a highly complex procedure involving many factors. In one instance, a soluble oil emulsified with water in a given ratio was being used with entire success until redesign of the work-piece necessitated a better finish. Personnel in charge did not realize that with the specific soluble oil in use a simple change in water-to-oil ratio would give the desired finish, so they embarked on a time-consuming and expensive program of testing various products. An experienced cutting- and grinding-fluid engineer could have solved their problem with little or no loss in time and production. Often, a study of the requirements of a specific application may reveal that by using a different cutting fluid, production may be stepped up, tool life increased enormously, down time reduced, surface finish improved, and overall maximum economies realized.

It is essential that the responsibility for the proper cutting fluids be given to one individual or a group of individuals, depending upon the number of machines involved. Some plants permit department foremen or machine operators to use proprietary brand-name products preferred by them. Unfortunately, this situation leads to unnecessarily high inventories and excellent possibility of misapplications.

As mentioned before, the proper application of cutting fluids is influenced by many factors and is so complex that most fluid suppliers have available a corps of engineers to assist the user.

End Mills — Their Use and Care

The following suggestions have been made by the National Twist Drill & Tool Co., Rochester, Mich., to obtain maximum production and life in the use of end mills.

1. Mounting the end mill in the machine.

Run-out of end mills, when mounted in a machine spindle, is conducive to premature dulling or breaking of the tool. It is, therefore, important to check the end mill for concentricity, with respect to the machine spindle, since the maximum run-out should be considerably less than the feed per tooth. This precaution will divide the cutting load equally over the number of end mill teeth and decrease chatter and dulling of the cutting edges.

2. Feeds and speeds for end mills.

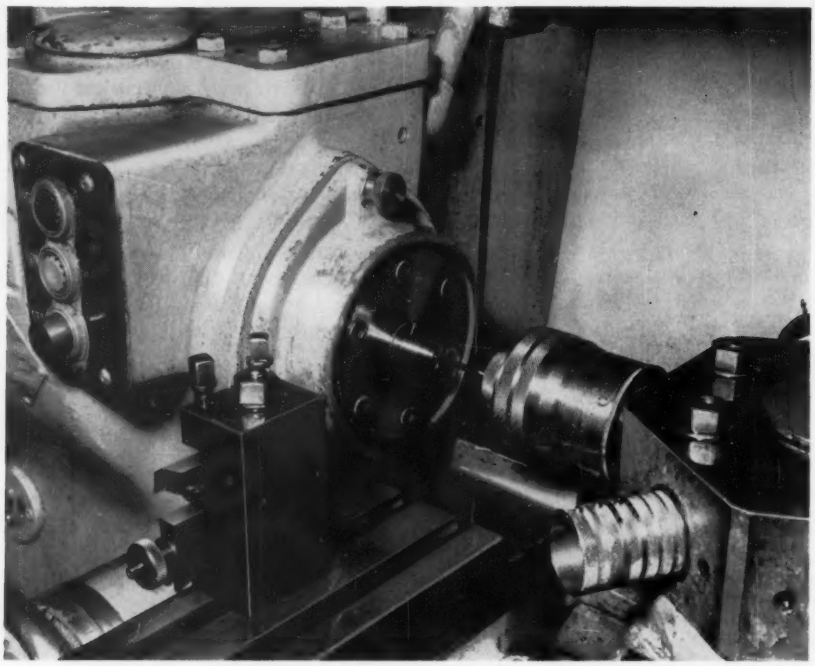
The greater the overhang of the tool in relation to its diameter, the less the permissible cutting feed load. In general, feeds for end mills should range from 0.0005 to 0.004 inch per tooth, depending on the diameter of the cutter, the number of teeth, and the amount of overhang from the machine spindle. Speeds for end mills in surface feet per minute, should be comparable to those used for other types of milling cutters.

3. Resharpening of end mills.

The resharpening of end mills is a critical and exacting procedure. Difficulty may be presented by the size and shape of the tools; necessitated by the operation for which they are intended. The primary requirement is that all cutting edges be made concentric to each other and to the shank of the tool. When an end mill cannot be mounted on centers for resharpening, an accurate chuck or holding device must be provided to maintain concentricity. The amount of relief behind the cutting edges is sometimes varied with the material to be cut; but, the relief must be suited to the diameter of the end mill. The smaller the diameter of the cutter, the greater the relief angle that is required to avoid rubbing of the heel on the land of the work.

Cutters having a small diameter must be resharpened with extreme care. Soft grinding wheels having a fine grit should be used, and the grinding operation done in easy stages. This will avoid burning or discoloration of the cutting edges. Small-diameter end mills should be examined after sharpening for fine burrs on the cutting edges resulting from the grinding operation. Such burrs are detrimental to finish and to long tool life, and should be removed with a fine hand stone before cutters are used. When not in use, end mills should be kept in individual containers to prevent damage to the cutting edges.

Deep-Hole Tapping of Titanium Alloys



By W. L. Carr
Assistant Foreman, Convair
A Division of General Dynamics Corporation
San Diego, Calif.

ALTHOUGH some difficulties in tapping alloys of titanium are commonplace, more than the usual amount were encountered during the manufacture of turnbuckle barrels. Two sizes of barrels were being produced, requiring 10-32 NF threads and 5/8-18 NF threads, respectively. Specifications demanded that the first barrel be tapped 1.13 inches deep (approximately six diameters) and that the second barrel be tapped to a depth of 1.75 inches (approximately three diameters).

Heat Builds Up Quickly at Cutting Edges

When working with a titanium alloy, such as RC-130B, the heat generated at the cutting edge builds up rapidly as the tap advances into the hole. This has a tendency to cause the tap to freeze and break. A free-cutting tool will cause some reduction in this heating. The problem remains complicated, however, due to the difficulty of getting an adequate supply of coolant past the shallow flutes of a 10-32 NF tap and, in turn, from these flutes to the many cutting edges involved.

Standard Tap Geometry Required Modification

Conventional 10-32 NF taps that were tried would not reach the required depth, while standard 5/8-18 NF taps proved unsatisfactory from the standpoint of the number of parts produced. As a result of continuous testing, it was found necessary to radically modify standard tap geometry and to change the normal sequence of machining operations. All tests were made on turnbuckle barrel production runs rather than in the laboratory—hence the validity of the results.

Four-flute taps were unsatisfactory due to a lack of strength in the narrow lands. On the other hand, the amount of material removed by each tooth of the two-flute taps developed such a load that the tool bodies failed. Three-flute taps proved to be an acceptable compromise.

Optimum chamfer angles and relief were the first problems attacked. Taps with taper chamfers galled and froze before reaching the first full-form thread. Those with bottom chamfers resulted in tooth chipping. Improved results were obtained with taps having a four-thread chamfer with a 0.010-inch relief.

Further experiments demonstrated that the shearing action of a spiral-point tap, as compared to a conventional hand tap, distributed the cutting load more evenly and reduced the strain on the tool. Continuing the high hook angle of the spiral point throughout the length of the flute also improved results. The slight additional cutting action obtained seemed to alleviate excess heating of the straight section of the tool and, therefore, its resultant binding.

Despite these changes in tap geometry, results were still unsatisfactory when using full-form tools. A further reduction of heat-causing friction was obtained by changing to interrupted-thread taps. Although the smallest tap available with interrupted threads was 1/4 inch in diameter, special 10-32 NF taps were made on request by the Threadwell Tap & Die Co., Greenfield, Mass.

Carbon Deposits in Work Material Hampered Tapping

Test runs with the special tools proved, in general, to be encouraging. Some taps would produce several parts, but, surprisingly enough, there was a wide variation in results. When employing uniform machining methods on identical material, some would tap several holes before failing, others only a few threads. This seemed to indicate that the titanium alloy being worked might have some bearing on these fluctuations.

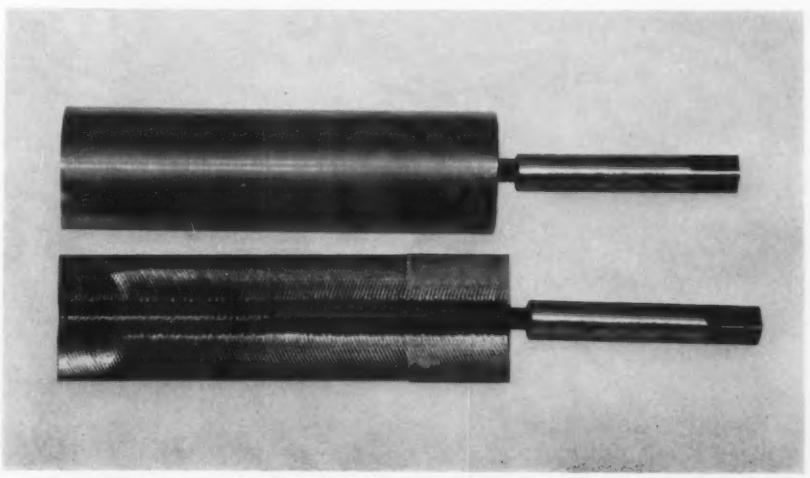
Samples of the part in various stages of manufacture were sent to the testing laboratory for analysis. Test specimens were prepared and photomicrographs taken. From these it was noted that some parts contained carbon deposits on the surface of the hole.

Because of this finding, two recommendations were put forth. The first stated that carbon content of the alloy be held below 0.10 per cent. The second recommendation concerned the melting technique employed so as to prevent hard spots due to carbon segregation. Also, it was assumed that the operational sequence, in which the outside of the barrel was machined before tapping, either increased the hardness of the work or decreased its ability to dissipate the heat generated. Drilling and tapping the components prior to machining their outer surface yielded the best results.

Further refinements, including modifying the spiral point angle from 15 to 8 degrees, were tried and approved. Various types of surface treatment were compared, medium nitride with black oxide being adopted. If the teeth were too soft they would roll over, if too hard they would chip. It was recommended, therefore, that they be kept within a hardness range of 61 to 63 Rockwell C.

A pitch-diameter back-taper of 0.0015 to 0.0020 inch reduced the occasional seizing that was still being encountered. Greater improvements resulted from slightly relieving the pitch diameter to the cutting edge. Hollow-ground lands were the final refinement.

As a result of these changes in tool design and alterations in tapping techniques, it was finally possible to obtain a 65 to 75 per cent thread with a 10-32 NF tap in a drilled, but unreamed, hole on a production basis. Cutting speed ranged from 12 to 15 surface feet per minute, using an active sulphur-base cutting oil. Similar results were obtained with the 5/8 NF thread using the same innovations.



Tapping long holes in turnbuckle barrels manufactured from a titanium alloy cannot be accomplished satisfactorily with off-the-shelf tools. Alteration of the tool point, hook and relief angles, and also the use of an interrupted thread form were found to be necessary.

"3-in-1" Plant Makes Standard and Special Electric Motors

WHAT is believed to be the world's most modern induction motor factory has been unveiled this spring in Schenectady, N. Y., by General Electric's Medium Induction Motor Department. The plant, designated Building 85, was built at a cost of approximately $7,000,000. It is designed to meet today's rapidly expanding motor market, which is expected to increase at least 75 per cent, industry-wide, by 1965. Standard models of GE's new "Tri-Clad 55" 7 1/2- to 30-H.P. alternating-current motors can now be produced in three eight-hour shifts, in contrast to the two-week period required previously.

The plant is, in effect, three factories in one. Two outer lines are high-volume, low-variety manufacturing facilities using flow and mechanization techniques to mass-produce 100 standard models, comprising 60 to 70 per cent of the total volume. The center line, on the other hand, is a low-volume facility, which draws standard parts from the two outer lines and then modifies them to turn out a virtually infinite variety of special motor types. Such manufacturing separation prevents the "specials" from slowing down the "standards."

One of the outer lines, described here, manufactures forty standard models, all having NEMA

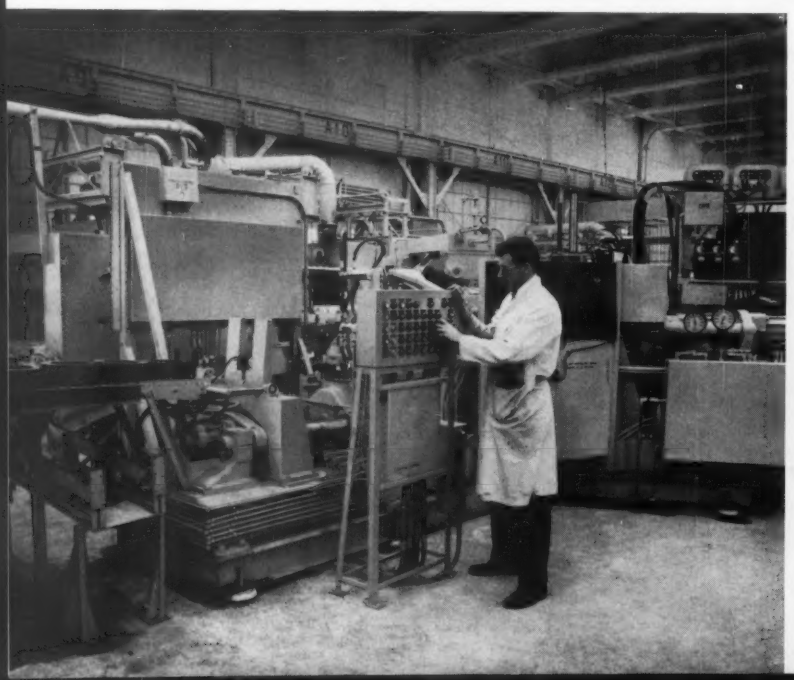


Fig. 1. Stacks of stator cores are welded around their periphery. The welding adds strength, gives better alignment and magnetic property.

Fig. 2. End shields are machined in this area of the plant. New design permits the basic end shield to be adapted to many motor types.

254 U and 256 U frames. Since these frames all have the same diameter, the problem of mechanizing certain operations has been greatly simplified.

Perhaps the highest degree of mechanization is in the press area, where rotors and stators are blanked from roll steel. One of the seven presses is shown in the heading illustration. Rotors leave the press on one conveyor, stators on another. The conveyors advance the work underfloor and, because of their steep angle, are magnetized. Other conveyors remove all scrap.

From the presses, stators move by a gravity-fed conveyor to a welding station, where stacks of the laminations are fused around their periphery to form the magnetic core of the motor. The welding operation, seen in Fig. 1, is directed from a panel. Cores then flow through an annealing furnace and into a winding area.

In a fully automatic operation, the wound stators pass through three ovens in a dip-and-bake processing cycle of about six hours. They are progressively preheated, immersed in varnish, baked, dipped in paint, again baked, and finally

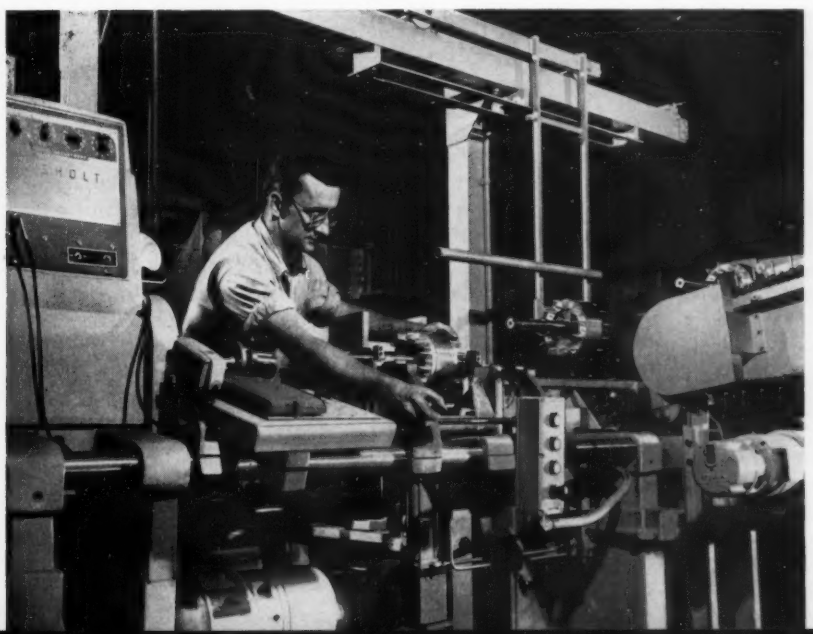


Fig. 3. Rotor sub-assemblies are dynamically balanced. Imbalance is corrected by riveting washers to die-cast surface at appropriate points.

Fig. 4. All motors receive running, sound, and electrical characteristics tests automatically on rotating tables at the end of each standard production line.

dipped in silicone. Hand operations are limited to loading and unloading.

Cast-iron stator frames are processed on a multiple-station transfer type boring, drilling, and tapping machine. Frames have been redesigned on a "building block" principle—one frame now being used for both open and splashproof motors. The latter require only the addition of two louvers in the frame openings.

End shields are shown being machined on Bullard Mult-Au-Matics in Fig. 2. The number of different covers and screens required was reduced by making the openings the same size and shape on all end shields of a given diameter. This, in turn, has reduced the number of patterns and tools, as well as the handling of parts necessary to manufacture the same variety of products as before.

After the stator core is pressed into the frame, this part of the motor meets the end shields in the assembly area. Rotor laminations, meanwhile, receive a coating of special varnish which improves their electrical properties. Then the laminations are placed in a die-casting machine, where the rotor bars, end rings, and fan are produced in one piece of molten aluminum. From the die-casting machine, the completed rotor cores travel on an overhead conveyor, joining the motor shafts, which are machined in high quantities on automatic lathes. Shaft and core assemblies then are dynamically balanced on Gisholt Dynetric machines, as in Fig. 3.

Assembly of castings, cores, ball bearings, seals, and other components into the complete motor is done on a transfer type materials-handling device which holds the parts in accurate alignment. The assembled motors pass on to an automatic test stand, Fig. 4. Here, in two stations, the motor is checked for noise, vibration, and quality of insulation. If the motor fails to meet the rigid standards of any one of these tests, it is automatically rejected and does not pass down a final assembly line leading to painting, boxing, and shipping.

* * *

Increased Use of Stainless Steel in Aircraft Predicted

Republic Steel Corporation predicts that tomorrow's supersonic planes will consist of 50 per cent or more stainless steel, needed for its ability to resist corrosion and heat and still maintain strength. For surface heat created by skin friction, Type 301 stainless is prescribed—it contains 17 per cent chromium and 7 per cent nickel.

For high-heat uses such as jet engines, Type 410 stainless is recommended where temperatures run to 800 degrees. For higher temperatures, up to 1400 degrees, Types 321 or 347 are specified. Above 1400 degrees, Type 310 joins the list. Generally speaking, the higher the temperature, the higher becomes the chromium and nickel content of the stainless steel to be used.

INGENIOUS *Mechanisms*

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Intermittent Rotation for Instrument Pointers

By GEORGE G. HERZL, Philadelphia, Pa.

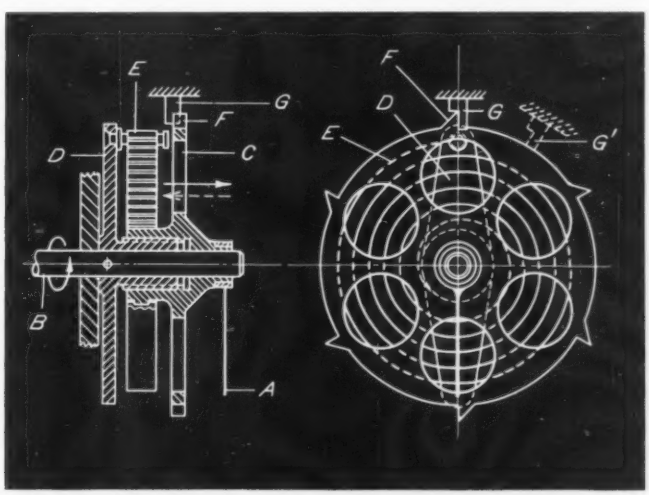
A mechanism that converts the continuous rotation of a shaft to the intermittent rotation of a stop-wheel is shown in the accompanying illustration. One suggested use of the device is for instruments where it is necessary to keep track of fractional parts of a shaft rotation. In the application illustrated, the angular position pointer *A* follows the shaft *B* with a quick motion each time the shaft completes a 60-degree rotation.

Basically, the mechanism consists of a clutch that engages and disengages automatically by the axial movement of one of the parts. This axial movement is derived from the continuous rotation of the shaft by a screw and nut action.

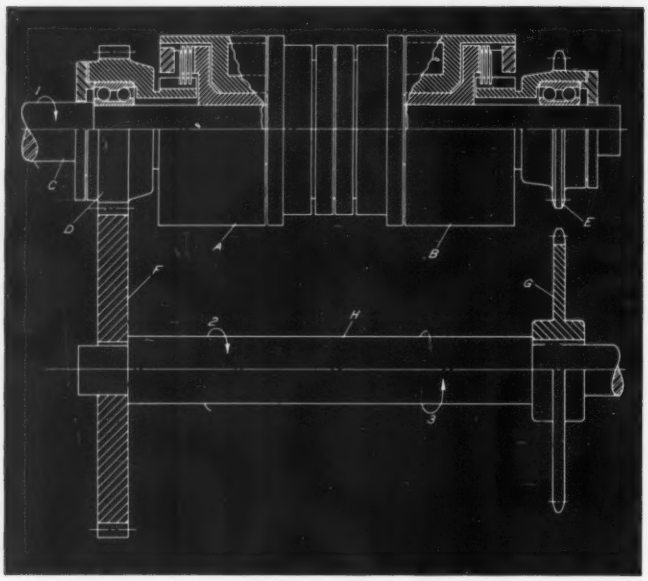
Stop-wheel *C*, carrying the pointer, is mounted freely over shaft *B*. Also over the shaft, but pinned to it, is an arm *D*. An integral stud on the arm is threaded externally, and engages an internal thread on the stop-wheel. Fastened to, and wound around, the hub of the stop-wheel is a flat coil spring *E*. The outer end of this spring is connected to the arm. As the shaft and arm rotate (in the direction of the arrow on the shaft) the spring attempts to transmit this motion to the stop-wheel. However, this member is prevented from turning by the blocking of one of the lobes *F* on the wheel by a stop *G*. Instead, the wheel moves axially to the right (as indicated by the solid arrow) because of its threaded engagement with the arm. Then, when the stop-wheel has moved out sufficiently to clear the stop, the tension built up by the spring causes the wheel to rotate faster than the shaft and thus reverse its axial direction (the broken-line arrow).

Since this particular stop-wheel has six equally spaced lobes, it will rotate 60 degrees before the next lobe abuts the stop. Double frequency can be obtained by adding a second stop, *G'*.

The mechanism can be utilized in applications where the rotation of the input shaft itself is intermittent rather than continuous, since there will be a corresponding effect on the stop-wheel. For simplicity, the pointer is shown carried directly by the stop-wheel. However, if the angular movement of the pointer has to be increased or decreased, a gear transmission can be added.



When shaft (B) rotates, stop-wheel (C) moves axially until lobe (F) clears stop (G). The stop-wheel then rotates 60 degrees.



Rotation of output shaft (H) can be reversed by the action of a double clutch without altering the rotation of driving shaft (C).

Double Clutch Permits Reversal of Driven Shaft

By J. J. Pot, Slikkerveer, Netherlands

In modern plants, it is frequently desirable to have control over the rotational direction of a driven shaft. A simple set-up that provides this control, without altering the direction of rotation of the driving shaft, is shown in the accompanying illustration.

A double electromagnetic clutch, consisting of units *A* and *B*, is mounted on driving shaft *C*. Two drive members, gear *D* and sprocket wheel *E*, are mounted on ball bearings and are in contact with clutch units *A* and *B* respectively. Driving gear *D* meshes with driven gear *F*, and driving sprocket wheel *E* is joined to driven sprocket wheel *G* by a link chain, not shown. Both of these driven members are keyed to output shaft *H*.

Shaft *C* rotates in the direction shown, arrow *1*, at all times. When it is desired to have shaft *H* rotate in the same direction, arrow 2, clutch unit *B* is energized. This results in the transmission of power from sprocket wheel *E* to sprocket wheel *G*, while gear *D* idles. If, on the other hand, it is necessary to rotate the output shaft in the direction shown by arrow 3, clutch unit *A* is energized. Sprocket wheel *E* then idles, as power is transmitted from gear *D* to gear *F*. If desired, the chain drive can be replaced with a belt drive.

Mechanism Loops and Twists Wire Ends

By Ralph T. Stewart, Winston-Salem, N. C.

Completion of a certain job necessitated the production of wire components having a twisted loop at each end. The soft steel wire parts were required in lengths of 16 inches and longer. A typical twisted loop is shown at X in the accompanying illustration.

Hollow shaft *A* is a running fit on drive shaft *B*, and is coupled to it by means of a clutch, a portion of which may be seen at *C*. This clutch allows shaft *A*, shown at Y, to rotate one-half revolution for each complete revolution made by shaft *B*. During the remaining one-half revolution of the drive shaft, shaft *A* dwells. Keyed to the left-hand end of the hollow shaft is mounting disc *D*.

Disc cam *E*, having two notches F_1 and F_2, is keyed directly to the drive shaft. The purpose of the cam is to actuate follower rollers G_1 and G_2 which, in turn, pivot levers H_1 and H_2. This ac-

tion either causes the jaws of clamps J_1 and J_2 to close or permits them to open under the influence of springs K_1 and K_2. The two clamps, together with their actuating levers, are mounted on disc D. There is a second complete unit (not shown), identical to the one illustrated, at the left-hand end of shaft B to twist a loop in the opposite end of the wire part.

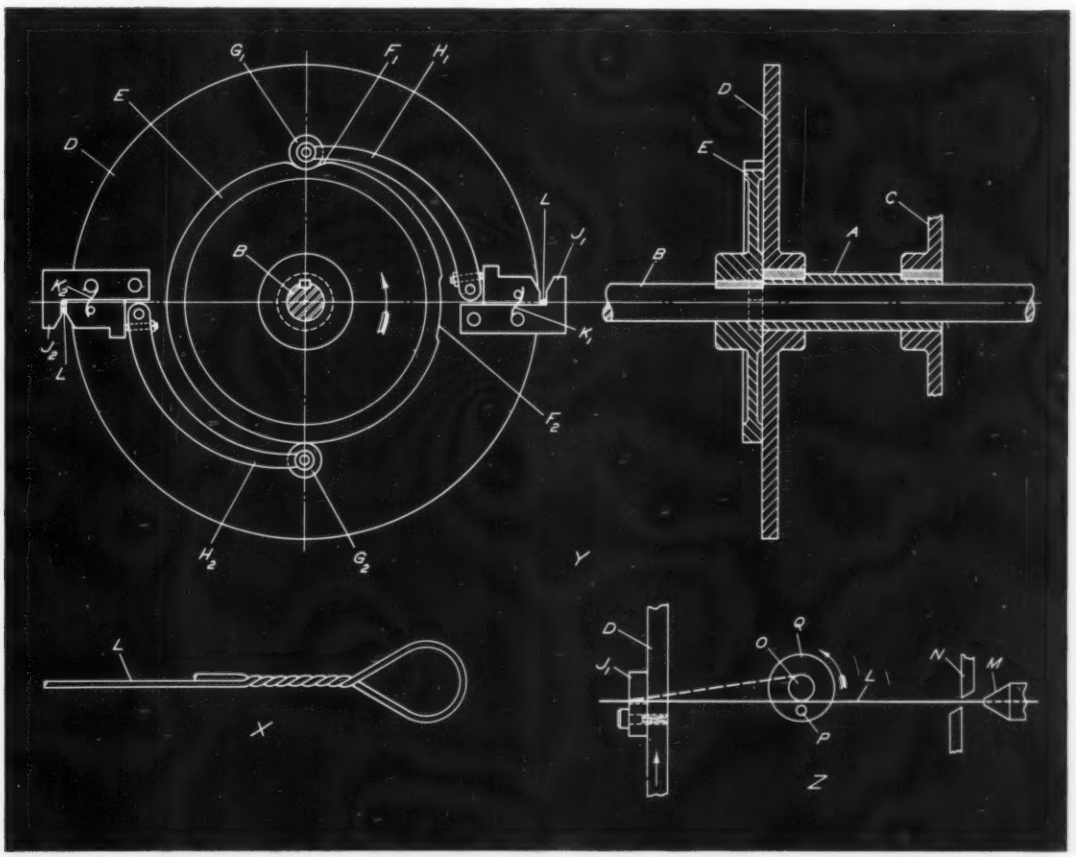
In operation, the wire L to be formed is fed through guide nozzle M, as shown at Z, between two cutting blades N and then between two pins O and P of looping head Q. When the correct developed length of wire has been fed out, clamp J_1 moves up from below to nest it. At this point clutch C releases, with the result that the clamp remains stationary while cam E continues to rotate.

As this occurs, follower G_1 leaves notch F_1 and rides up on the high portion of the cam, forcing the clamp jaws to close on wire L. Cutting blades N now shear the wire, and looping head Q rotates, thus forming a loop in the wire end around pin O by the action of pin P. The wire end comes to rest in the V-shaped entrance to the clamping jaws and is held in this position by the pin P.

As cam notch F_2 arrives under follower G_1, the clamp jaws are permitted to open a sufficient amount to allow the wire end to drop in place. The passing of the notch once again closes the jaws, locking the looped wire securely in place while the looping head is retracted.

By this time, cam notch F_1 has arrived under follower G_2, allowing the jaws of clamp J_2 to open wide. At this instant clutch C engages, causing disc D and cam E to once again rotate in unison for one-half revolution. During this movement, clamp J_2 moves up into contact with a newly fed length of wire, which begins the next cycle.

While in this position, with clamp J_1 dwelling at a location 180 degrees away from its starting point, a twisting head engages the clamped wire loop. This head, not shown, completes the twist as shown in the illustrated example of the workpiece. Following the twisting operation, cam notch F_1 moves beneath follower G_1, allowing the clamp jaws to open and to drop the finished wire components clear of the machine. The cycle of operation then continues.



Device loops and clamps wire component, then transfers it on a rotary disc to a point where the loop is twisted into the form shown at X.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Lathe and Gaging Fixtures Locate Work from Internal Groove

By W. M. HALLIDAY, Southport, England

While machining large quantities of trunnion sleeves, difficulty was encountered in locating an external annular groove. The trunnion sleeve, which can be seen at X in Fig. 1, has a finish-machined bore and, within this bore, a finished annular groove. The difficulty was due to the requirement that both the external and internal grooves be aligned to within close dimensional tolerances.

An efficient arbor type lathe fixture, shown at Y, was designed to fulfill this condition of alignment. The main member of the fixture is a long cylindrical steel body *A*, having an over-all length approximately twice that of the component to be machined. At the left-hand end of the body is a large integral flange with a locating plug, for registering with a lathe faceplate, machined on its outer face.

A key *B* is fixed to the body so as to engage freely within a keyway in the bore of the work-piece. This key takes the full load in driving the trunnion sleeve during the turning and grooving operations.

Sliding freely within a hole bored diametrically through the body is a cylindrical steel locating slide *C*. The length of the locating slide is about 1/8 inch less than the body diameter at that point. Machined across the upper end of the slide is a tongue that is shaped to fit within the internal annular groove in the work-piece.

Locating slide *C* is moved transversely within the body by means of an inclined actuating pin *D*, which is secured in a spring-loaded plunger *E*. The plunger rides in a counterbored hole in the right-hand end of the body member.

A cap *F* is screwed into the bored end of the body member. The outside diameter of the cap must be flush with the abutting end of the body. Through this cap is threaded an actuating-screw *G*, the tip of which bears against the flanged end of the spring-loaded plunger.

Two circular clamp-nuts, H_1 and H_2, are

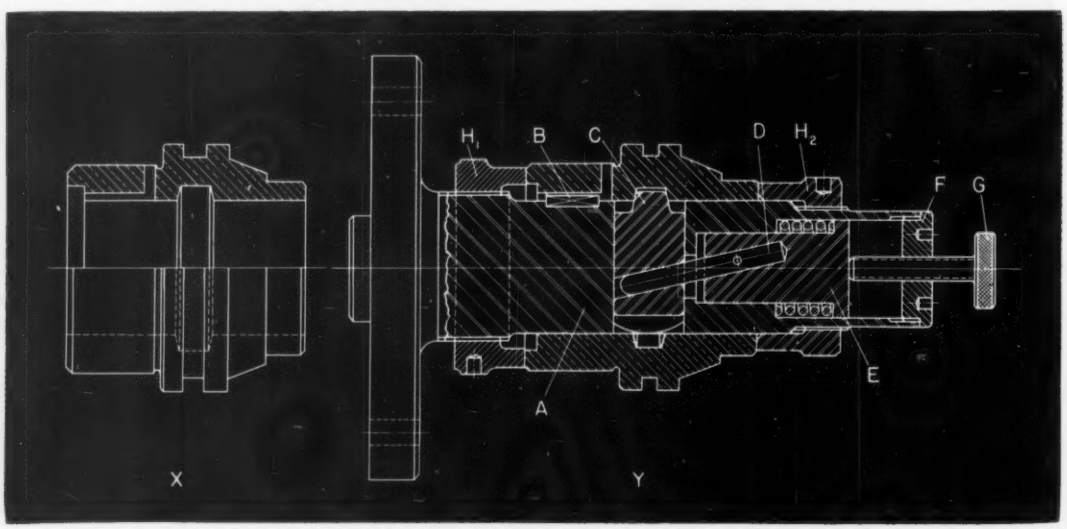


Fig. 1. Lathe fixture with movable tongued slide locates work-piece from internal annular groove

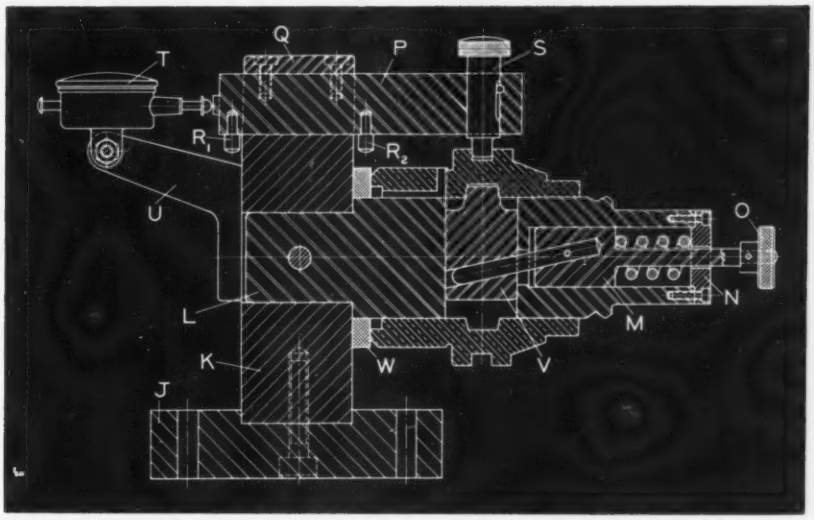


Fig. 2. Gaging device for checking alignment of the groove machined with the lathe fixture seen in Fig. 1

threaded on the body at either end of the work-piece to lock it in place after it has been located correctly. The outside diameter of the two clamp-nuts should be slightly smaller than the finished diameters of their adjacent trunnion sleeve steps. Holes are provided in both these nuts, and also in cap *F*, to accommodate a spanner wrench.

With the fixture bolted to the faceplate of a lathe, the work-piece is mounted for machining. To do this, clamp-nut H_2 is removed, and clamp-nut H_1 is backed off slightly. Actuating-screw *G* is also backed off a sufficient amount to allow the crest of the tongue on locating slide *C* to drop below the surface of the body.

The partially machined work-piece is then slipped over the body as shown, with its left-hand side almost touching nut H_1. Actuating-screw *G* is advanced to the left, forcing plunger *E* in the same direction, which causes locating slide *C* to move outward. The formed tongue on the upper end of the locating slide engages the internal annular groove in the work-piece. Screw *G* is turned until the work-piece can no longer be moved by finger pressure. Clamp-nuts H_1 and H_2 are then run up against the ends of the part.

Inspection of the finished groove is facilitated by the gaging fixture illustrated in Fig. 2. The fixture base is a cast-iron plate *J*, drilled for hold-down bolts. A rectangular column *K* is pressed into a slot milled across the top face of the base-plate and is held in place by cap-screws.

A step on the left-hand end of body-shaft *L* is a press fit in a hole bored through column *K*, and is secured by a pin. The remaining portion of the body-shaft is similar in construction to the lathe fixture, with a few minor alterations as shown.

One of these alterations is the configuration of plunger *M*. Integral with the plunger is a smaller shaft which protrudes through end cap *N*. On the end of this smaller shaft is pinned a knurled knob *O*. A stiff compression spring urges the plunger toward the left.

A rectangular steel bar *P* is a sliding fit in a deep slot machined across the upper end of the upright rectangular column *K*, and is retained by keeper-plate *Q*. Mounted in this way, the bar should be free to slide a short distance horizontally, being restricted by two small shoulder-studs R_1 and R_2.

Headed gaging-pin *S* fits accurately within a vertical hole in bar *P*, and is prevented from turning by a pin that bears against a flat on the side of the gaging member. The lower end of the gaging-pin is formed to an accurate fit with the machined groove to be checked. When in the raised position, the formed end of pin *S* must clear the work-piece.

A conventional dial indicator *T* is supported by bracket *U*. The contact point of the indicator bears against a lapped tongue projecting from the end of bar *P*.

To mount a work-piece on this gaging fixture, it is only necessary to pull knob *O* to the right, which permits locating slide *V* to drop clear. The trunnion sleeve is then slipped over the body-shaft, the groove and bevel at the forward stepped end of the shaft preventing jamming of the part. When the part contacts rubber ring *W*, the knob is released, and the top end of the locating slide enters the internal annular groove.

Gaging-pin *S* is depressed until its lower end engages the external groove. Any error in groove location will cause bar *P* to shift a corresponding amount. Variations, if any, from the required position of the groove can be read on the dial indicator. This is assuming, of course, that the indicator was pre-set to the correct reading.

Trepanning Tool of Unusual Design

By A. G. Amos, Calcutta, India

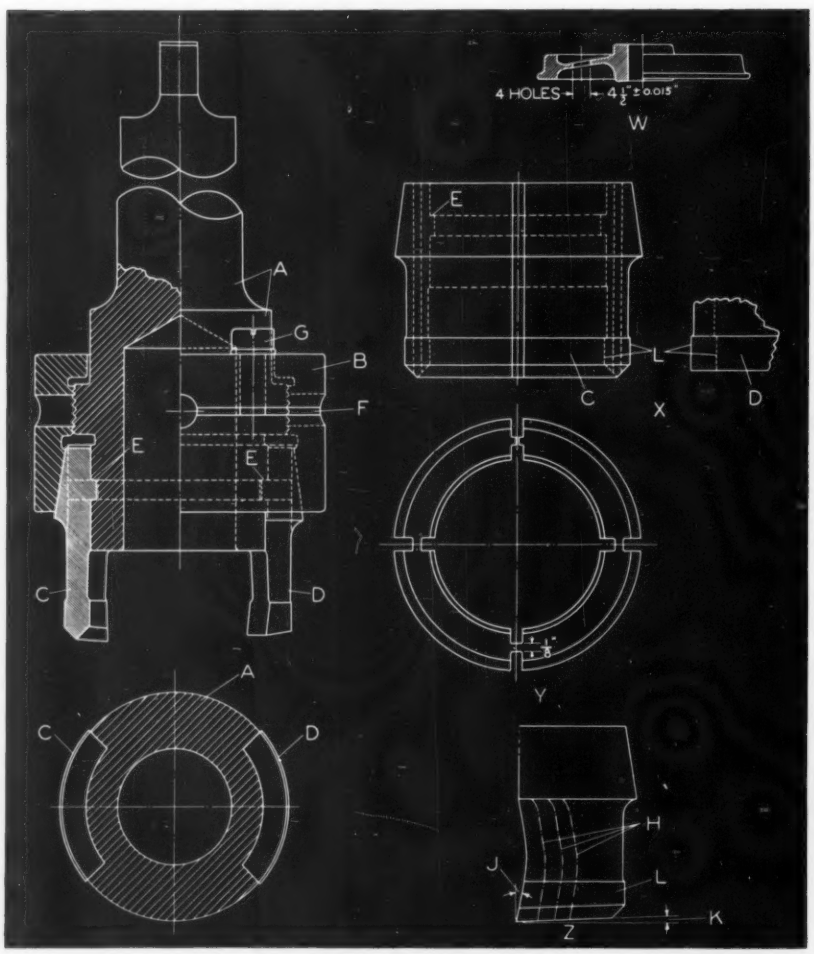
When cutting 4 1/2-inch diameter holes in the web of steel car wheels, ordinary trepanning tools often broke and required time-consuming grinding and resetting. An unusual trepanning tool was therefore developed which utilizes two cutters and is capable of taking heavy cuts.

There are essentially four main parts to the tool, body *A*, tightening sleeve *B*, and cutters *C* and *D*, as seen in the accompanying drawing. The body has a No. 6 Morse Taper and is bored out at the bottom end for lightness. Coarse left-hand threads on the body engage the tightening sleeve which is bored and ground on its lower end to fit the tapered ends of the cutters.

The cutters are seated by fitting shoulders *E* into recesses in body *A* and are secured to the body as a tapered conical surface on sleeve *B* is moved downward on corresponding surfaces on the cutters. This is accomplished by screwing sleeve *B* on the threads of the body. In trepanning, the upward thrust of the cutters is taken by shoulders *E*. To keep the sleeve tightly screwed, it is split at *F* and locked by screw *G*. The cutting edges of the two tools differ in shape in order to reduce the cutting load.

As shown in view Z, a cutter may be reground several times along lines *H*, which extend to as much as one-half the width of the cutter and still have sufficient cutting surface for further service. The front rake angle *J* and the clearance angle *K* are about 15 degrees and 5 degrees, respectively. Section *L* on the cutter is relieved about 0.008 inch on both the inside and outside for clearance. This does not exceed the tolerance of plus or minus 0.015 inch allowed on a hole in the wheel web, as shown in view W.

To simplify making of cutters, two pieces of flat steel stock are heated and rolled into circular shapes with their ends meeting as closely as possible. After being annealed, one ring is machined to the shape seen at *C* and the other to shape *D*, as shown in view X. The rings are then slotted into four sections, each section being connected by a 1/8-inch bridge, as seen at Y. Each segmented ring is heat-treated, hardened and tempered, and finally separated into four pieces, thus providing four pairs of cutters.



The heavy-duty cutters held by this unusual trepanning tool have different forms in order to reduce the load on each cutting edge.

Machine Tools Guided by Magnetic Tape

COMPLEX machine tool operations can be performed automatically under the guidance of digital "instructions" that are automatically computed and recorded on magnetic tape. The numerical control device that permits this type of machining to be accomplished is called the "Digimatic" and is a development of Electronic Control Systems, Inc., an affiliate of the Stromberg-Carlson Co., and a subsidiary of the General Dynamics Corporation.

The device consists of two principal units—a planning desk, Fig. 1, the main part of which is a high-speed decimal computer and tape recorder, and a machine control unit that governs the operation of a machine tool by "instructions" on the magnetic tape. To prepare for an operation, the dimensions of the finished part are first fed into the planning desk, in sequence, through a keyboard similar to that of an adding machine. After each dimension is entered into the keyboard, the operator presses a button marked "compute." This is a signal to the computer to take that dimensional data and convert it into the proper numerical instructions which it simultaneously records in pulse form on the magnetic tape. The computer not only converts the dimensional information into the correct number of electrical pulses but it also checks itself.

Fig. 1. Operator is entering dimensions of the work-piece into the planning desk. The magnetic tape is in the base of the desk. At the left is the computer cabinet and at the right is the power-supply cabinet.

One of the important features of "Digimatic" is its ability to compute and record the proper instructions for milling true curves. Instructions telling the computer whether to produce straight lines or curves, and, if the latter, in which direction, are given by simply setting two dials on the keyboard.

After all the instructions have been computed and recorded on the magnetic tape, the tape is rewound and played back to the machine control unit. A machinist merely clamps the blank in a fixture and inserts a tool in the spindle. This is the only part of the procedure in which an operator is required.

Servo motors on the milling machine, Fig. 2, follow the tape-recorded instructions and move the work-table back and forth and up and down until the part is completed. During the operation, sensing devices keep watch over the motions of the machine to make sure that they correspond to the instructions on the tape.

It is possible to produce identical parts in distant locations by providing duplicate tapes. The "instructions," which are in the form of electrical pulses, can be transmitted by telephone or radio and another tape produced at the receiver end.

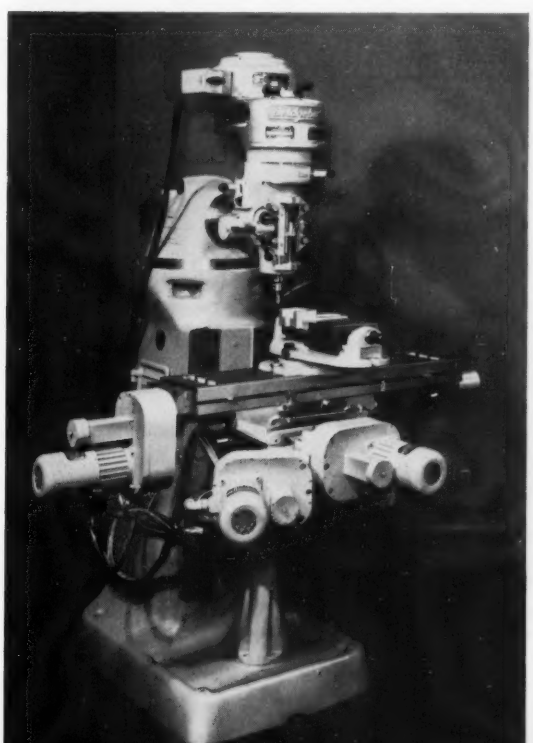


Fig. 2. A vertical milling machine is equipped with servo motors to control the movement of the table. Numerical instructions, automatically computed by the planning desk and recorded on magnetic tape, guide the machine operation.

MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Finding the Center and Radius of an Arc Tangent to a Circle and Passing Through a Fixed Point

By JAY N. EDMONDSON, Professor, Industrial Engineering, Ohio State University

Points *A* and *T*, shown in Fig. 1, represent location points on the underside of the skin of an airframe. That portion of the skin shown as a heavy line is part of the arc of a circle having a radius *R* and center *C*. The positions of points *A* and *B* are known; also that point *T* is on an arc of 0.93-inch radius from *B*; and that *R* must make a 13-degree angle with the horizontal, as shown.

In order to position other units on the underskin, additional points between *A* and *T* on the large arc must be determined. To do this, it is necessary to find *R* and coordinates *x* and *y* of center *C*.

Solution:

The perpendicular bisector of a chord *AT* would pass through *C*. The position of this chord, however, is not known. Another line parallel to

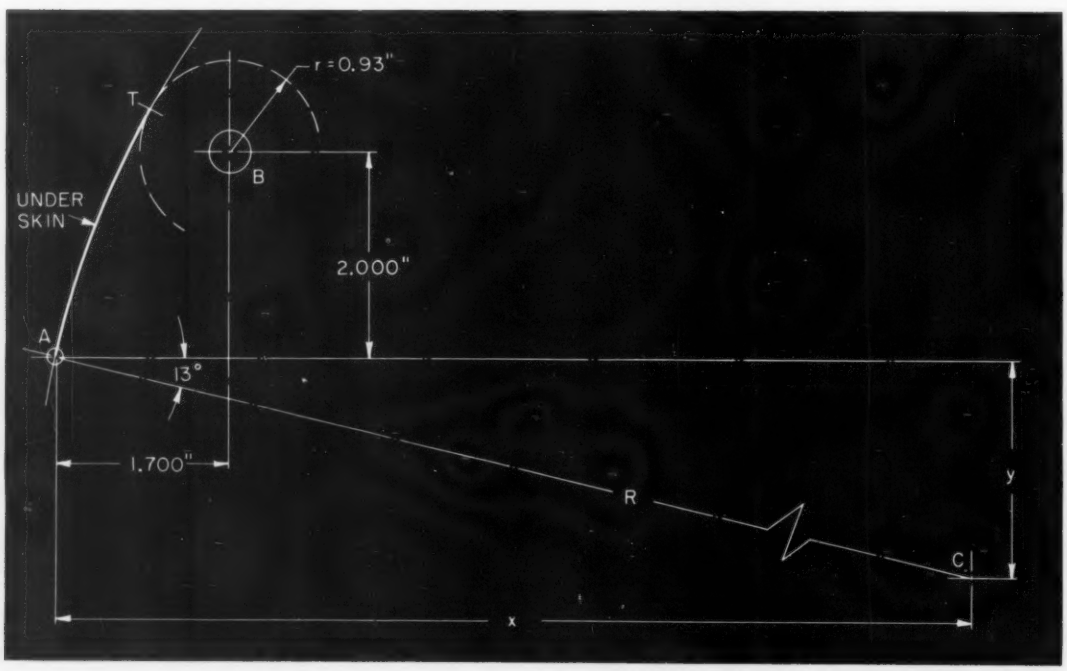


Fig. 1. To locate other points between (A) and (T) on the underskin of an airframe, it is necessary to determine the radius (R) and the location of the center (C).

chord AT and in a similar triangle with common legs would also have the same bisector through point C.

This line, EB in Fig. 2, can be found by laying out a distance $AE = 0.93$ inch along AC and connecting point E to point B. Line EB is thus known to be parallel to chord AT by construction. If EM, which is one-half of EB, and angle CEM are determined, then triangle EMC can be used to find CE. Radius R would then equal $CE + AE$.

1. In triangle ABD,
   $$\tan c = 1.700 \div 2.000 = 0.85000$$ and
   from a table of trigonometric functions,
   $$c = 40°21.9'$$

2. $b = 90° - c = 49°38.1'$

3. $AB = 2.000 \div \cos c = 2.625$

4. In triangle ABD, two sides and the included angle are known, $AB = 2.625$, $AD = 0.93$, and $a = b + 13° = 62°38.1'$. Using a customary trigonometric formula (page 276, MACHINERY'S HANDBOOK),
   $$\tan d = \frac{0.93 \times \sin 62°38.1'}{2.625 - (0.93 \times \cos 62°38.1')}$$
   $$= \frac{0.93 \times 0.88809}{2.625 - (0.93 \times 0.45965)}$$
   $= 0.37584$, so that
   $d = 20°35.9'$

5. From the law of sines,
   $$BE = \frac{0.93 \sin 62°38.1'}{\sin 20°35.9'}$$
   $$= \frac{0.93 \times 0.88809}{0.35181}$$
   $= 2.348$

6. $EM = 1/2 \times BE = 1/2 \times 2.348$
   $= 1.174$ inches

7. In triangle EMC, angle CEM is $83°14'$, (supplement of angle AEB), so that
   $$CE = 1.174 \div \cos 83°14' = 1.174 \div 0.11783$$
   $= 9.964$

8. $R = 0.93 + CE = 10.894$ inches

9. $x = R \times \cos 13° = 10.894 \times 0.97437$
   $= 10.615$ inches

10. $y = R \times \sin 13° = 10.894 \times 0.22495$
    $= 2.451$ inches

The use of logarithms is recommended in problems of this kind if a calculating machine is not available to carry out the numerous multiplications and divisions. For example, in Step 1,

$$\log \tan c = \log 1.700 - \log 2.000$$
$$\log 1.700 = 10.23045 - 10$$
$$\log 2.000 = \underline{\quad 0.30103}$$
$$\log \tan c = 9.92942 - 10$$

$c = 40°21.9'$ by interpolation from a table of logarithms of trigonometric functions.

Similarly, for Step 3,

$$\log AB = \log 2.000 - \log \cos 40°21.9'$$
$$\log 2.000 = 10.30103 - 10$$
$$\log \cos 40°21.9' = \underline{\quad 9.88192 - 10}$$
$$\log AB = 0.41911$$

$AB = 2.625$ by interpolation from a table of logarithms of numbers.

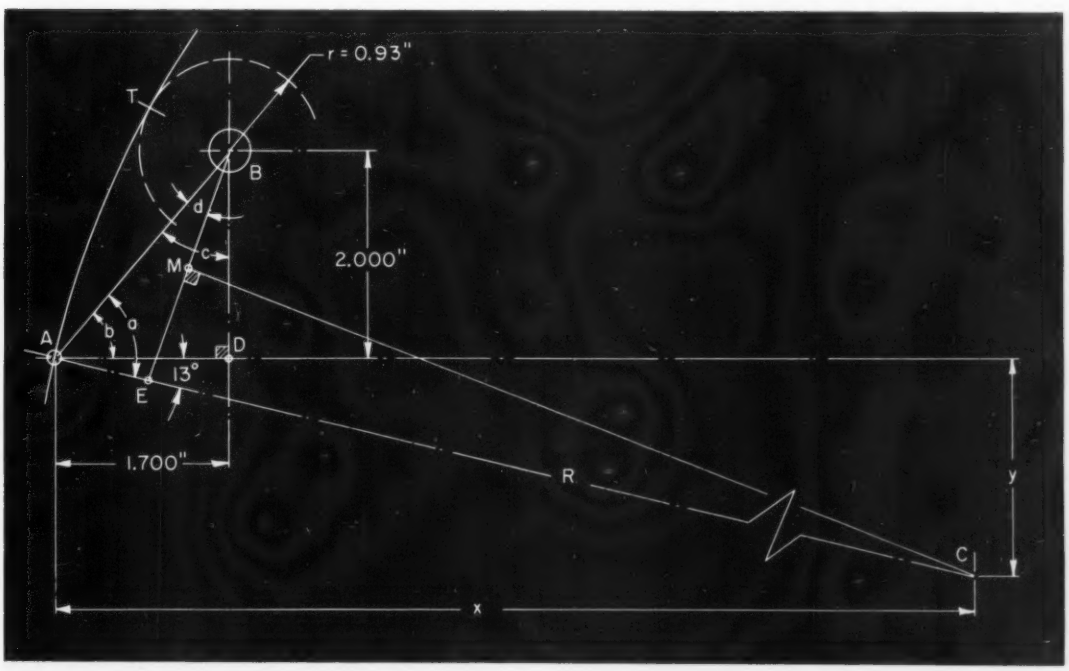
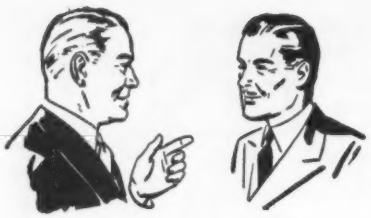


Fig. 2. The various triangles shown here are needed in trigonometric calculations of radius (R) and the (x) and (y) coordinates of the center (C) in Fig. 1.



Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Mergers Affect Markets and Selling

"To keep ahead in this industrial selling game, we must be wide awake to current transitions in the form of corporate organization and the methods of administration and operation. These definitely affect our sales future." The machinery sales manager here quoted went on to explain the trends toward plant decentralization and increased mechanization.

"But what is relatively new is the increase in building of giant corporations by purchasing others. Rounding out families of manufacturing and servicing companies to collectively serve chosen markets has grown in popularity. Efficiency in management and control is supposedly attained. Diversification will cushion the damaging effects of a business depression and even out the peaks and dips. Furthermore, a corporation—like a parent adopting a child—may lighten its tax burden. Ironically, a small company losing money may be a jewel of high price. One recent 'for sale' advertisement featured 'excessive losses'!"

One morning we may read of an old-line manufacturer closing its doors, and the next, of a newly formed corporation taking under its wing one of our best customers. Just recently, a small tool manufacturer complained of losing a good account—his customer had been absorbed by a large corporation. Word had been passed down to this subsidiary to give first consideration to another supplier.

Since the impact of a merger and the usual plan to diversify may greatly affect future customer relations and business, every sales manager faces a challenge to get closer to his customer market. Actually, the changed sales tactics should be based upon a phase of market research too often ignored. It is the study of the plans and policies toward growth on the part of each prospect.

Obviously, customer planning of this sort first takes place largely under cover. Various plans are suggested and evaluated, and when one is chosen, the merger is announced and takes place. A stage of consolidation and adjustment follows. Top management is often loath to suddenly upset the established conduct of a newly acquired company. But it is only a matter of time before one sees the strong hand at work with resultant changes in policy, personnel, and procedure.

How can the sales manager and the sales engineer meet these industrial market changes to protect existing business and cultivate more?

We sometimes overlook the importance of selling at two levels. Of course, service selling at the everyday level comes first. But, with industry on the move, close contact with those who plan, make policies, and administer is necessary. The approach of sincere interest in the customer's progress and success, and the desire to help, invariably strike a sympathetic note. At the top level we sell broad ideas, not so much product and performance.

We must give closer study to the functional operations within the family of a merged company. What is the division of authority between member and parent? Where do ideas originate? Whose opinions count for the most? Who makes decisions? Team selling on the part of the vendor grows in importance.

As mergers take place among our customers, personnel changes more frequently take place. We must not only study "who is who" but "who is likely to be who" in the future. Our mailing lists must be revised and kept up to date.

To summarize:

Direct market research toward a study of the customer's plans for growth.

Develop closer top level contact with customers.

Alert each sales engineer to detect and report customers' plans—even "grapevine" gossip.

As mergers occur, find out how buying methods work. Mold sales and service to meet new needs.

Easy? No. But the prize goes to those who intelligently prepare, courageously decide, and then follow through.

Improved Alloys Produced by Vacuum Melting

IMPROVED alloys for corrosion-resistant, high-temperature, and high stress applications will be produced with the vacuum-melting furnace recently installed at the Cannon-Muskegon Corporation plant in Muskegon, Mich. Metallurgical-chemical analysis equipment has also been added to expanded facilities available to the metal-working industry for experimental and production work. In addition, the plant includes facilities for investment, shell-mold, sand, and permanent-mold casting.

The specially designed Stokes vacuum furnace, which at present is equipped for pouring 300-pound heats, is primarily intended for production of iron-, nickel-, and cobalt-base alloys up to temperatures of 3000 degrees. It operates at less than 10 microns of pressure. Basically, the furnace consists of a tank, 6 feet in diameter and 7 feet long, in which a lip-pouring induction furnace is mounted on trunnions. The tank, made of carbon steel and lined with stainless steel, is water-jacketed to prevent overheating.

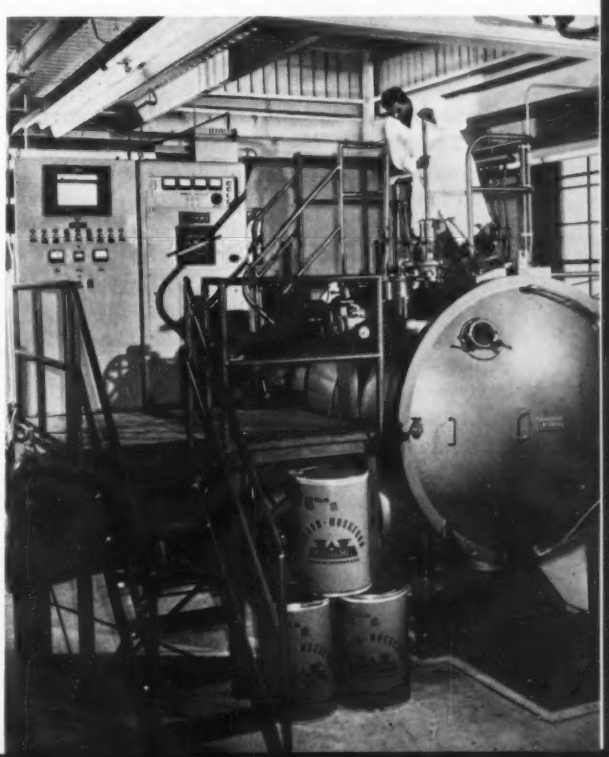
A rotary table, 3 feet in diameter and mounted in front of the furnace (inside the tank), carries different molds into position for pouring, or can be used for centrifugal casting. During melting, ingredients can be added and temperature readings taken through a vacuum lock arrangement. Power for melting (220 amperes, 440 volts) is supplied from a Tocco 100-K.W., 3000-cycle, water-cooled motor generator set. Oil is recirculated through a Hilco reclaiming unit.

Cast bars, 1/2 inch to 6 inches in diameter, are made for the investment casting industry. Also, the facilities are being used for development work on vacuum castings and to produce cast ingots and billets up to 250 pounds for processing by rolling, forging, extrusion, or machining.

Cannon-Muskegon plans to continue giving help to companies developing special alloys and also to produce known standard alloys by vacuum melting. Thus, a company now producing a part from a conventionally produced alloy can do research and development for this part using a vacuum alloy with a view toward product improvement. Heats of 300 pounds can be poured in an average melting time of about three hours. Planned production this year is 20,000 pounds per month.

Alloys produced by the vacuum-melting process will include stainless steels, tool and die steels, high-temperature alloys, corrosion-resistant alloys, bearing steels, magnetic alloys, electrical and electronic alloys, and expansion alloys. Among the principal improvements of vacuum-melted alloys are longer life at higher temperatures under stress, higher ductility at room or elevated temperatures, longer fatigue life, higher tensile strengths, greater cleanliness, and higher purity. Among the present applications for these alloys are races for instrument bearings, thrust bearing for the main shaft in jet engines, plates and wheels for turbo-jet engines, and such heavily stressed airframe components as landing gears, bolts, and main spar anchors.

Coincident with the installation of the vacuum-melting furnace, Cannon-Muskegon has enlarged facilities for complete chemical and metallurgical evaluation of the alloys it produces. This equipment includes an X-ray fluorescence spectrometer. Also, facilities have been provided for heat-treatment, physical testing, and air induction heating.



Vacuum lock arrangement on top of cylindrical tank permits adding ingredients to high-frequency melting furnace mounted inside tank or taking temperature readings with a thermo-couple.

Machine Tool Magic Revealed at Twentieth Electrification Forum

TRACING by scanning a drawing with a cathode-ray tube . . . positioning a machine-tool slide with a transducer . . . running a turret lathe from a perforated tape. A record attendance of more than 600 electrical engineers, designers, production engineers, and representatives of the technical press heard and discussed papers on these and other timely topics at this year's Machine Tool Electrification Forum. Held in Buffalo, N.Y., April 17 and 18, the Forum, sponsored by the Westinghouse Electric Corporation, observed its twentieth year.

Tracing Without Templates

J. M. Morgan and O. L. Bailey, Cincinnati Milling Machine Co., described their company's new line-tracing system. A cathode-ray "flying spot" tube provides a source of light which is projected onto the master drawing. The spot of light is modulated vertically and horizontally on the face of the tube by a reference generator and a beam shaper to produce a small, bowed arc. Reflection coils around the tube are geared to rotate with a hydraulic steering motor and feed cam. As the beam scans the line being traced, pulses of light reflected by the line are converted by the tube to electrical pulses and fed to a photoamplifier where they are converted to an error signal. This signal is zero when the beam is centered over the line.

In operation, if the beam is reflected to one side of the line, the output from the photoamplifier causes the motor to rotate, turning both the feed cam and the scanning beam to center the beam over the line.

Slides Positioned by a Transducer

A new type of transducer, developed by Canadian Westinghouse, allows the measurement of linear displacements to accuracies of 0.0001 inch over distances of several feet. The device can be applied to the slides and carriages of all machine tools where cutters must be accurately positioned. Frans Brouwer, Canadian Westinghouse, described its application to an engine lathe.

The transducer consists of two parts electromagnetically coupled. The primary part is an insulated bar wound with wire to form a bifilar coil. Like the primary part, the secondary part is a bifilar coil but is wound on the inside of a sleeve sliding over the primary part.

In the engine lathe, the carriage cross-slide is driven with a lead-screw from a servo motor through a gear-box. The secondary coil is mounted on the cross-slide, while the primary coil is mounted in bearings so that it is free to revolve. This axis is parallel to the direction of cross-slide travel. Alternating current is supplied to the transducer, and its output after amplification is fed to the servo motor. The motor moves the slide until it reaches the nearest position at which the transducer gives zero output. Similar null positions repeat at points spaced apart by distances equal to the lead of the transducer coils. Intermediate positions can be obtained by revolving the primary coil.

Numerical Control for a Turret Lathe

D. N. Smith, Jones & Lamson, explained the design and function of a numerically controlled turret lathe brought out by his company. The system employed is a straight binary type coincidence circuit. Basic turret lathe design was modified to provide proper response and freedom from friction and drive system windup problems. Input from the control system is from a perforated tape. Positional information in digital form is read from the tape for the end point to which the turret is to be moved and for the feed rate. This information is held in relay storage until the command has been executed. A hydraulic servo drive relieves the precision lead-screw of any significant load.

Among other papers presented at the Forum were those relating to a programed positional feed-back control for machine tools; safety considerations for press controls; automation and machine control gaging; work-handling within, and between, machine tools; basic aspects of numerical machine tool control; a single dimension digital program for contour milling; silicon rectifiers for machine tool application; and new NEMA standards for direct-current motors.

Westinghouse technicians disclosed new refinements in Cypak static controls, introduced initially to the machine tool industry a year ago. The new Mark II Cypak element is now a rugged, potted assembly, permitting considerable flexibility of control system design. Performance reports on Cypak installations were made by S. F. New-

man, General Motors Corporation, and R. W. Kowitz, Ford Motor Co.

Louis Polk, president of the National Machine Tool Builders' Association, and president of the Sheffield Corporation, in addressing the Forum contended that unless mechanization is accelerated, the nation's available labor force may be insufficient to turn out the future indicated volume of goods and services demanded by a constantly ascending standard of living. Mr. Polk based this conclusion upon a chart, computed on an index basis, which showed the trends of total employment, physical volume of industrial production, and output of electrical energy over the past twenty-five years, and projected these trends twenty-five years into the future.

Golden Anniversary of Co-Operative Education Celebrated at the University of Cincinnati

THE University of Cincinnati recently concluded a week-long celebration of the fiftieth anniversary of co-operative education. Concentrating on the theme "Education and Industry at Work for Progress," the observance pinpointed the contributions of co-operative education to the growth of America.

A growing need for education that combines classroom theory with industrial practice was put forth clearly in an address by Dr. Winston E. Kock, director of audio and video systems research, Bell Telephone Laboratories, Murray Hill, N. J. He stated, "American industry is today facing a serious shortage of college graduates in the fields of science and engineering. This shortage has been brought about in part by the rapid expansion of our industrial facilities and in part by industry's continued strong participation in the supplying of our defense needs of the present and future. An intensive search for college graduates to fill these needs is accordingly now under way, and, in this search, industry has incurred the responsibility of ensuring that this new talent will be employed with a maximum effectiveness, so as to maintain a strong industrial America and to create a high standard of living for ourselves and others."

Co-operative education, as conceived and founded at the University in 1906 by the late Dean Herman Schneider, is an integrated program of classroom study and related practical work experience. Students alternate seven-week periods of learning theory on the campus with equal periods of practical application in their field. By the end of their five-year program, students find that they have gathered more than the required amount of practical knowledge necessary to start full-time jobs without long break-in or training periods. In fifty years the co-operative plan has been adopted by some forty colleges and universities here and other schools abroad.

The celebration was sponsored by a group of American industrialists headed by Frederick V. Geier, president of the Cincinnati Milling Machine Co., and Cyrus R. Osborn, vice-president of General Motors Corporation. It was highlighted by educational exhibits from more than seventy-five corporations, arranged in a "Panorama of Progress" in the University's Field House. The exposition dramatized America's technological advances in the past fifty years.

Among the exhibits was a graphic display of progress in steelmaking that was sponsored jointly by the Armco Steel Corporation and the Youngstown Sheet & Tube Co. The exhibit, complete with 30-foot working models of steel mills, showed fifty years of progress in steelmaking. A functioning model of an old hand-operated sheet mill illustrated how sheets were made in 1906. In contrast was a working model of a modern continuous hot strip mill such as is used in steel plants today.

The public also saw a successive display of engines including a 1910 Wright Brothers internal combustion engine and a cut-away, life-size working model of the General Electric J-47 power plant. A look into the future was provided by a cut-away model of a typical rocket engine. Included was an animated exhibit of the probable mechanics involved in launching a satellite.

The "Americade"—a preview of a new era in American history—was also seen by visitors to the University. This twenty-two unit exhibit of the National Association of Manufacturers depicted anticipated life in the United States in the year 1975. Spectacular exhibits portrayed our country's potential for tremendous advances in all areas of human achievement.

Eleven leaders in business, education, science, industry, and the arts were awarded honorary degrees by the University during special ceremonies on the opening day. Included among the recipients were Charles R. Hook, board chairman of the Armco Steel Corporation; Dr. Frederick L. Hovde, president of Purdue University; and Frederick V. Geier.

LATEST DEVELOPMENTS IN *Shop*

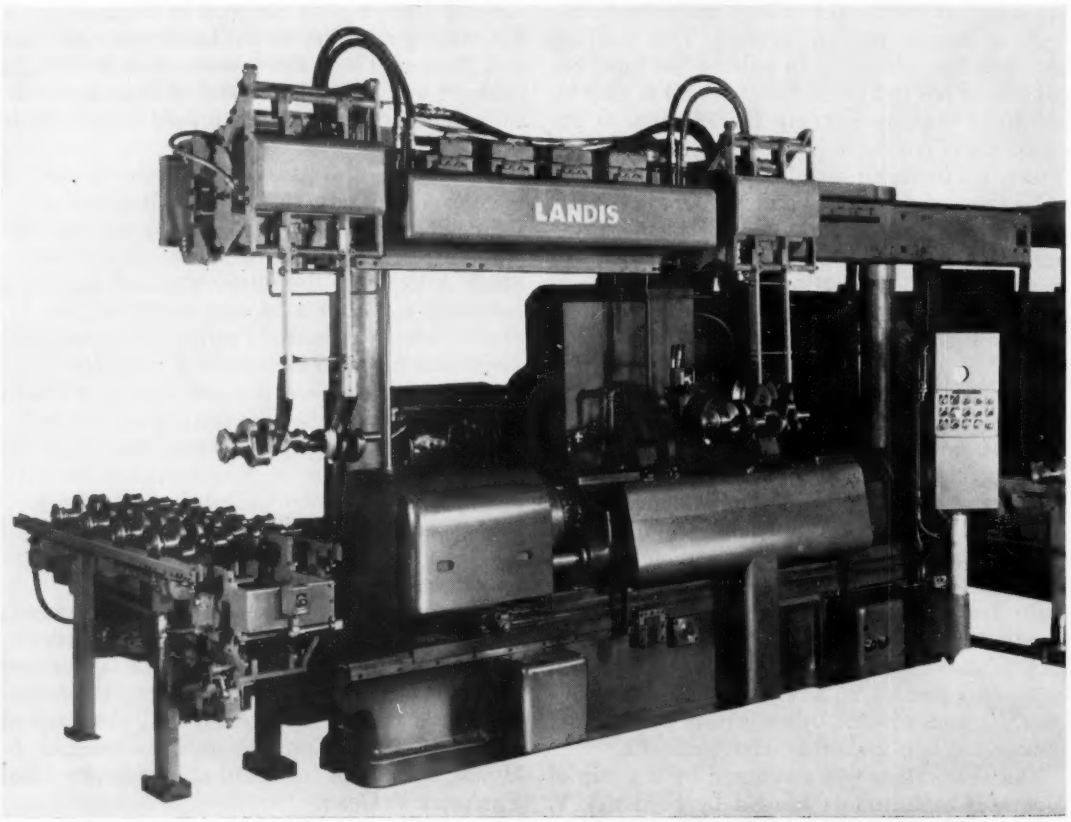
Landis Integrated Production Line for Grinding and Gaging V-8 Crankshafts

The Landis Tool Co., Waynesboro, Pa., has developed an integrated line of four Type DH automatic hydraulic crankpin grinding machines with an estimated production rate of fifty complete crankshafts per hour. The machines are complete with automatic loading, transfer, grinding, and sizing equipment. They grind the four crankpins and side walls of V-8 crankshafts, removing 0.020 inch of stock from each crankpin and 0.005 to 0.007 inch of stock from each side wall. The sizing equipment gages the work-piece between stations as well as during the grinding cycle.

The four grinding machines are synchronized electrically, hydraulically, and mechanically. Landis-designed loaders move the crankshafts from one machine to another automatically, one crankpin being ground by each of the four machines. There is no indexing from one crankpin to another to interrupt the machining cycles. The first machine in the line is shown in Fig. 1, complete with automatic loading and transfer equipment. This machine grinds the No. 4 crankpin of the V-8 crankshaft. One of the crankshafts may be seen in the close-up view of Fig. 3, where the third machine grinds the No. 1 pin to the required diameter and also finishes the side walls. After the No. 4 pin and the adjacent side walls have been ground in a similar manner on the machine shown in Fig. 1, the crankshaft is gaged in the automatic unit illustrated in Fig. 2.

The gaging unit is mounted on the racker of the work transfer system.

Fig. 1. Landis automatic hydraulic crankpin grinding machine with loading, transfer, and sizing equipment used with three similar machines for completely automatic operation



Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

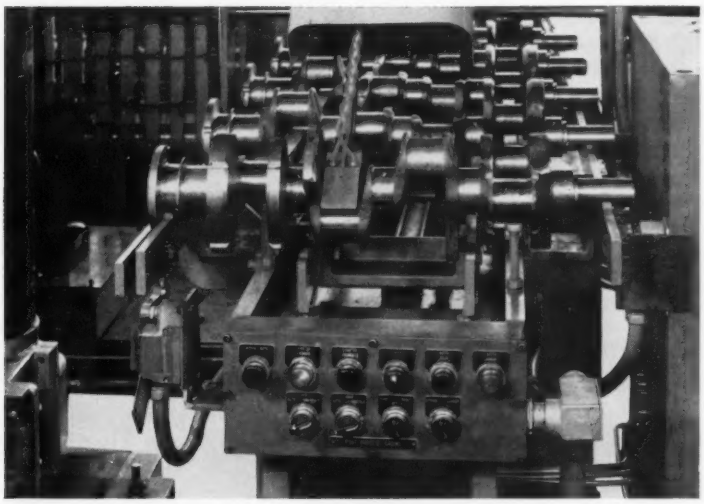


Fig. 2. One of four gaging units that tests work completed by each of four machines like one shown in Fig. 1

It checks the pin diameter and the space between the side walls. When the work is not within specified limits, the grinding cycle, which precedes the gaging station and racker, is held up until the required size correction is made. When correcting adjustments have been completed, the reset button is pressed, causing the machine to continue its cycle. The crankshaft is then transferred successively to the three remaining machines and sizing units or stations to complete the grinding and gaging operations, one pin and the adjacent side walls being ground on each of the four machines.

When the production line is in operation, crankshafts are deposited on the conveyor seen at the extreme left, Fig. 1. The loader picks up a single crankshaft, moves it transversely to the grinding position of the first machine, and lowers it into two chucks. Loader fingers swing out to clear the crankshaft as they return to the upper position. A gaging finger moves into position to accurately and automatically locate the crankshaft longitudinally between the chucks. Hydraulic pressure serves to clamp the crankshaft in both chucks.

The loader, which has a set of fingers at both the right- and left-hand ends, then returns to its original position. One set of fingers is now over the conveyor and the other set over the crankshaft. The grinding wheel moves rapidly into position to finish the side walls and grind the pin to the required diameter at the first crankpin position. The pin is ground to a predetermined size within limits of 0.0005 inch. A double-contact air gage, which is automatically positioned on the pin being ground, controls the grinding cycle through the feed and spark-out periods until the final size is reached. The grinding wheel is then withdrawn automatically and the crankshaft stops revolving with the chuck clamps in the proper position to permit opening so that the crankshaft can be lifted out vertically.

Withdrawal of the grinding wheel serves to actuate loaders, causing them to move the crankshaft from the first machine to a conveyor between the first and second grinders

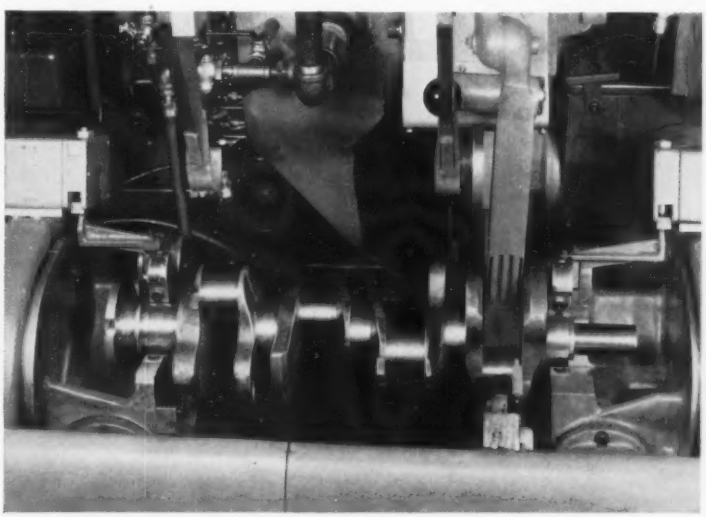


Fig. 3. Close-up of work and grinding wheel of third machine of Landis crankshaft processing line

where it is automatically inspected. If any of the dimensions do not pass inspection, signal lights show which dimension varies from the predetermined limits. The preceding grinding machine will stop cycling until the correction is made. A set of visual gages shows the inspection sizes so that the operator knows how much correction to apply.

This pickup, grind, pickup, inspect cycle continues through the four machines until the crankshaft is finished. All grinders and loaders are in continuous cycle operation so that four crankshafts are being handled at all times. The conveyors, between the grinders, have provision for storing a quantity of crankshafts. However, a loader will not operate unless there is a crankshaft ready for loading and a vacant space on the next conveyor to permit depositing a crankshaft.

If it is necessary to shut down one machine for changing wheels or for regular maintenance, the other three machines can be kept in operation. The crankshafts are bypassed around the machine that is shut down. The operation missed on the shut-down machine can be performed on a conventional hand-operated, stand-by machine. Complete safety devices are built into the machine system to prevent any damage to the machines or work.

Circle Item 101 on postcard, page 229

Buhr "Economatic" for Processing Torque Converter Housings

Sixty-two operations are performed on torque converter housings at a production rate of 200 per hour by an "Economatic" recently built by the Buhr Machine Tool Co., Ann Arbor, Mich. Some of the more important features of this twelve-station, forty-two foot long machine are: sectionalized bases designed to simplify processing changes; automatic depth-inspection of all holes before tapping; automatic lubrication of all moving parts; mist lubrication for all spindles to maintain uniform temperature in heads; and provision for arranging all spindles for pre-setting of cutting tools.

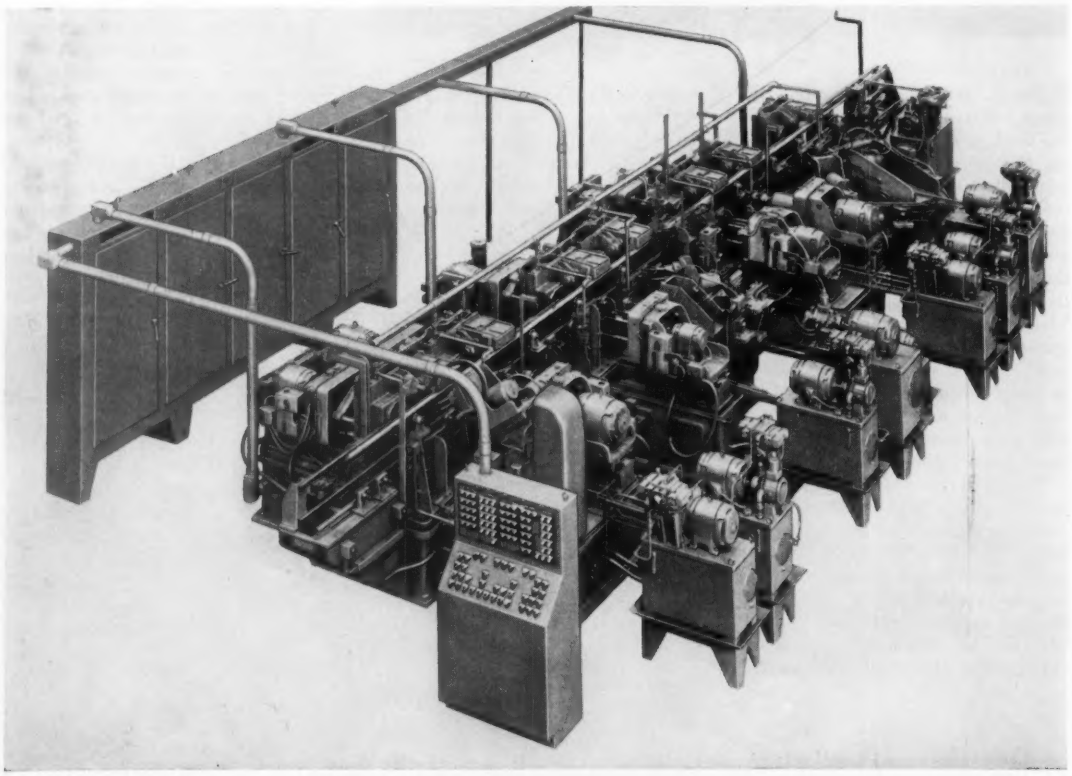
Operations performed by the machine include thirty-six drilling; two combination drilling and reaming; seven countersinking; two reaming; one boring; seven inspecting; and seven tapping. The twelve stations are: one for loading, seven for machining (including one for mechanical inspection), three for visual inspection, and one for unloading.

All standard and special parts of this machine are completely interchangeable; construction is to J.I.C. hydraulic and electrical standards; the hardened and ground steel ways are automatically lubricated; tapping spindles are of the individual lead-screw type with precision-ground and hard chrome-plated threads; and the multiple heads are of Buhr ball-bearing construction with shaved gears and broached and splined drives.

Circle Item 102 on postcard, page 229

Punch Press Feed

A hydraulic gripper type punch press feed for the automatic feeding of coiled stock is being made by Special Engineering Service, Inc., Detroit, Mich. Models are available for handling stock up to 36 inches



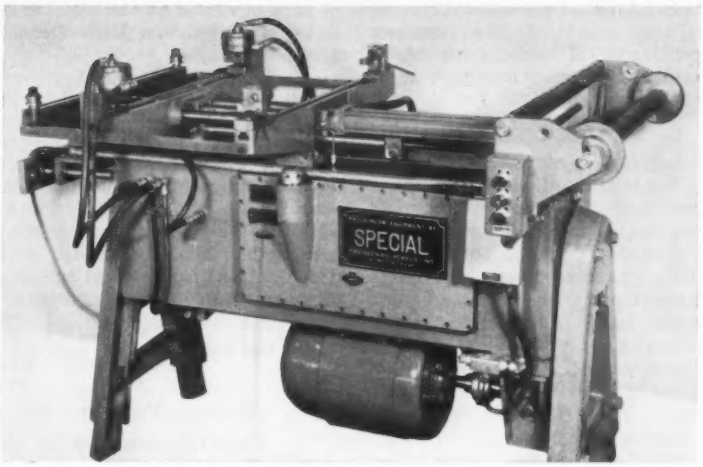
"Economatic" built by Buhr Machine Tool Co. for processing torque converter housings

wide by 3/16 inch thick for feed lengths up to 36 inches. All models are adjustable to take narrow width stock and for infinitely adjustable feed stroke lengths from zero to the maximum capacity of the unit.

The feed stroke can be adjusted by a small handwheel while the unit is operating. Adjustments for stock widths are made by a few turns of a wrench. The feed cylinder and all valving are standard items.

A limit switch, mounted on the press and actuated by any moving part of the press or die that is timed with the ram movement, energizes a solenoid which starts the feeding cycle. The stock is fed on the up stroke of the press.

Circle Item 103 on postcard, page 229



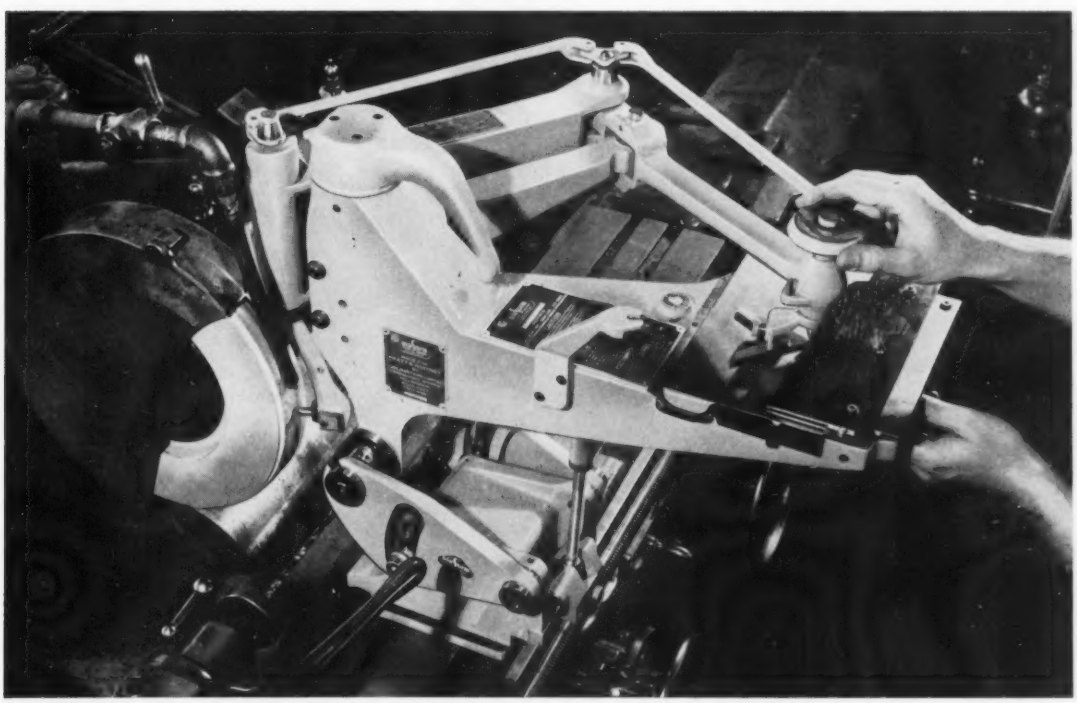
Hydraulic gripper type punch press feed made by Special Engineering Service, Inc.

"Diaform" Attachment for Forming Complex Contours on Grinding Wheels

Pratt & Whitney Co., Inc., West Hartford, Conn., has announced a form-truing attachment for use on universal internal and external cylindrical grinders. This attachment, known as the "Diaform" Model No. 10 Universal, supplements the present line of surface grinder type "Diaforms." The new model makes it possible to quickly form-true complex contours on grinding wheels to an accuracy of 0.0001 inch. Equally accurate repeat truings can be made as often as required.

Mounted on the grinding machine table by an auxiliary carriage, the "Diaform" is well out of the way during grinding operations, but is quickly available for re-truing without disturbing the work-piece. The auxiliary carriage provides vertical adjustment for centering the truing diamond to suit different makes of machines.

In operation, a tracer is lightly traversed over the profile of an enlarged template of the desired form. The path of the tracer is transmitted at a 5 to 1 reduction ratio, (which reduces any template error by the same ratio), to a truing diamond that accurately reproduces the form in the grinding wheel. Since a sharp



Pratt & Whitney "Diaform" attachment for form-truing grinding wheels

diamond is used, the wheel is dressed as it is form-trued. The maximum grinding wheel diameter that can be formed is 14 inches; maximum width of form produced on the wheel is 2 inches; and maximum depth of form 1 inch.

Circle Item 104 on postcard, page 229

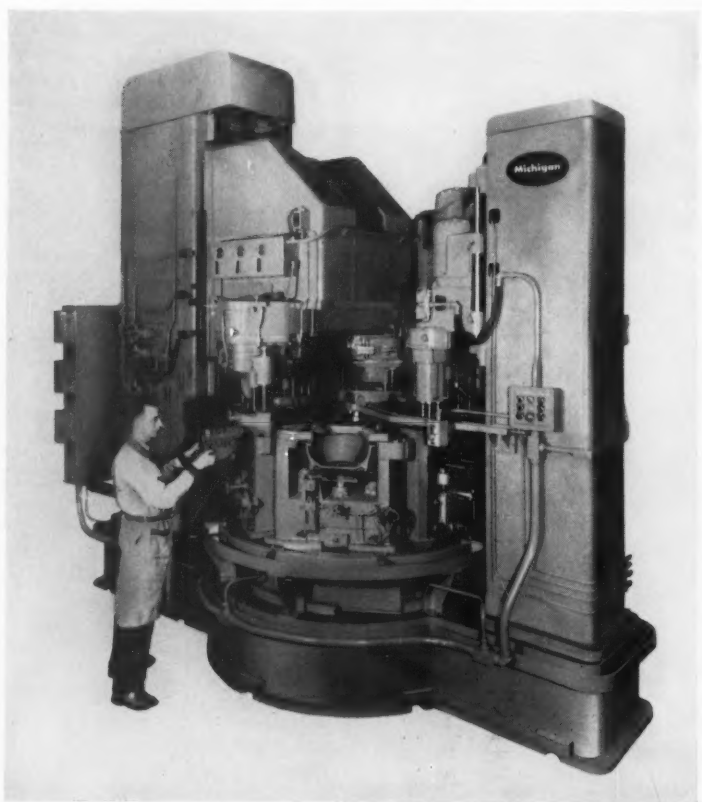
Machine for Processing V-8 Clutch Housings

The Michigan Drill Head Co., Detroit, Mich., has brought out a giant-size special machine for processing V-8 clutch housings. This machine drills, chamfers, rough- and finish-bores the starter hole; reams two dowel holes; spot-faces four inside bosses; and taps five holes in a V-8 clutch housing. It is designed to complete 120 clutch housings per hour, and with just a few simple tool changes, it can be made to handle two different housing models.

The machine is built of standard components, including a 60-H.P. Michigan Hydro 30 drill head; hydraulic feed unit; a Hydro 5 feed, which is a vertical 7 1/2-H.P. hydraulic feed unit; and a Michigan 60-inch hydraulic index-table.

Features include six work stations; power clamping; elevating type fixtures; and a unique method for the disposal of chips. Chip paddles, mounted on the periphery of the index-table, deliver the chips to a single trough at the rear of the machine. Automatic lubrication is provided, and J.I.C. electrical and hydraulic standards are maintained throughout the machine.

Circle Item 105 on postcard, page 229



Michigan giant-size special machine for processing automotive part

Walker-Turner Cut-Off Machine

A "Light-Heavyweight" line of cut-off machines announced by Walker-Turner, Inc., Plainfield, N.J., is now available for use with dry-cutting abrasive wheels adapted for cutting rod, bar and tubing stock. The same machines can also be used with high-speed saw blades and with conventional wood-cutting blades up to 12 inches in diameter. They are precision built to take true and clean cuts that in many cases eliminate the need for further finishing operations.

"Light-Heavyweight" cut-off machine announced by Walker-Turner, Inc.

The machines are available equipped with an air feed attachment designed for repeated production operations. They require no electrical connections and can be installed without preparatory machining. The air feed attachment can be used in connection with either automatic stock feed or hand feed.

An automatic spray coolant system, which supplies coolant to the blade while cutting, is available. A similar coolant system, using a recirculating pump, can also be supplied. The heavy cast-iron table is drilled so that the head can be mounted at an angle of 45 degrees for mitering, and the table can also be drilled and tapped for any desired work-holding devices. A 3-H.P. 220/440-volt 3-phase motor is supplied with each machine. The motor is totally enclosed, fan-cooled, ball bearing, and has an overload capacity of 7 H.P.

Circle Item 106 on postcard, page 229

"Cera-Met" Bond for Diamond Wheels

The Clipper Diamond Tool Co., Inc., New York City, has introduced a bond for diamond wheels called

"Cera-Met." According to the manufacturer, wheels made with this bond do not glaze, even if carbide and steel are ground at the same time. Although the life of wheels made with the new bond is claimed to be as long as that of diamond vitrified-bonded wheels, it is said that they will cut much faster and maintain sharp corners for a longer time. This characteristic lengthens the time between wheel dressing operations and thus lowers production costs.

The "Cera-Met" bond actually wets and adheres to each diamond grain regardless of how fine it may be. Each grain is gripped so firmly that it cannot be knocked out until worn flat, when a "break-away" action will release the diamond particle, thus exposing a fresh diamond edge. This action continues throughout the life of the wheel so that the grinding surface is always clean and sharp.

Circle Item 107 on postcard, page 229

Bliss Two-Point Enclosed Press with Left-to-Right Gear Drive

A two-point enclosed press that incorporates a left-to-right gear drive has been developed by the E. W. Bliss Co., Canton, Ohio. This press is said to require less floor space than previous front-to-back designs. The gear arrangement utilizes twin intermediate shafts which permit mounting the flywheel, clutch, and the motor drive between the shafts. This makes a compact drive system which is housed within a box crown that is symmetrical both right-to-left and front-to-back.

The press, manufactured with cast Meehanite frames, has capacities ranging from 150 to 750 tons. The 200-ton press shown in Fig. 1 operates at a speed of twenty strokes per minute. It has a slide stroke of 16 inches, slide adjustment of 12 inches, and a shut height of 32 inches on the bed. The bed is 84 by 48 inches. These "enclosed" presses are designed for use in automation production lines, all of the many air and electrical lines needed for auxiliary equipment being built into the massive uprights. In addition, doors and covers that provide access to electric, air, oil, and other systems are flush-mounted as are buttons, switches, and other controls. Other features include the use of Bliss automation control, including a precise electro-mechanical rotary switch, built-in lights over the die area, and automatic oil lubrication.

Fig. 2 is a side view of the press with panels removed to show how gearing is housed within the flush crown. In normal use, the panel is provided with gaskets, and the gears run in an oil bath. This view also shows how air and electrical lines run through conduits built in the uprights. The lower panel (access door removed) houses electrical controls, all of which conform to J.I.C. standards. The smaller panel immediately below it contains metering devices for the automatic lubrication system.

Circle Item 108 on postcard, page 229

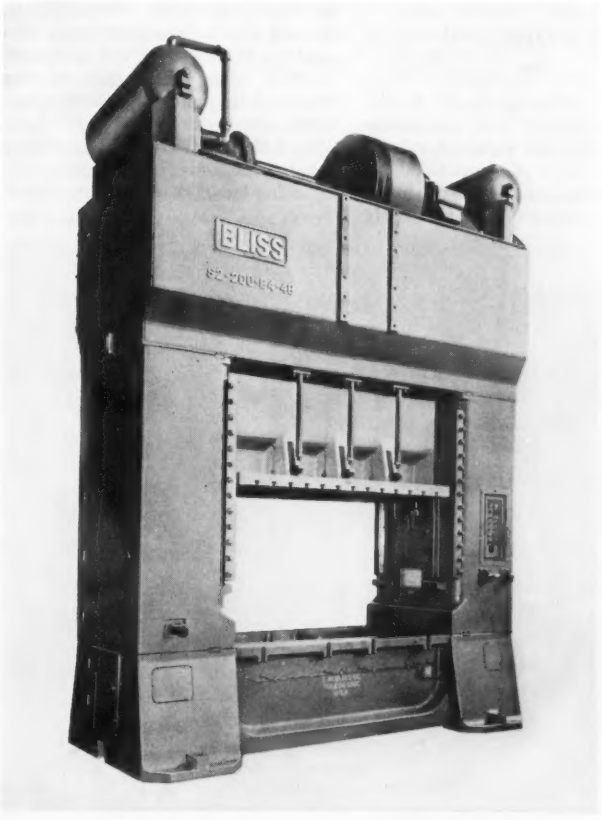


Fig. 1. Two-point enclosed press brought out by the E. W. Bliss Co.

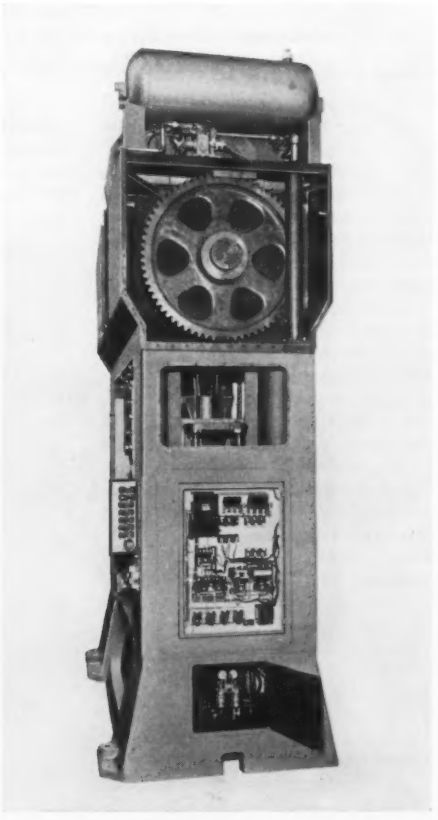
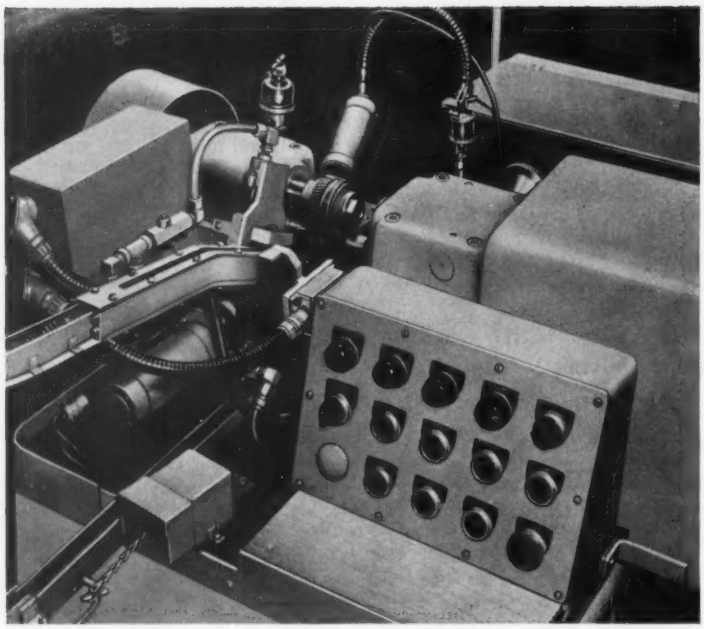


Fig. 2. Side view of press shown in Fig. 1 with enclosing panels removed.



Red Ring gear speeder inspection unit that automatically loads, speeds pinions for sound tests, and unloads pinions into a feed chute, diverting pinions that do not pass the test

Automated Red Ring Gear Speeder Equipped with Electronic Ear

A unique, fully automated Red Ring gear speeder—Model GSR—which includes an electronic "ear" that inspects and rejects gears which do not meet operating sound level requirements is now available from National Broach & Machine Co., Detroit, Mich. The machine handles the smaller sizes of pinion gears and is designed to provide precise selection of gears having uniform sound characteristics and to avoid human sound level appraisal errors.

Gears are automatically loaded, run in both directions in mesh with another gear with and without brake loading, unloaded, and passed or rejected by the electronic sound discriminator unit whose microphone is placed near the gear mesh area. The sound discriminator unit may be adjusted at any time to the range of audible noise frequency and intensity desired for rejection.

Pinions can be fed to the speeder unit from a conveyor unit or loaded manually into a magazine feed on the machine. Six of these sound discriminator speeders can sound test 14,000 pinions in an eight-hour shift.

Push-button controls are included for each machine function to facilitate set-up operations. Air cylinders control work-arbor, loader, and brake functions. Since the machine must operate at minimum sound levels, separate electrical and pneumatic control panels are included. These are mounted at a distance from the speeder unit to remove noise sources from the speeding area. The panels are of sound suppressed construction.

The speeder unit is powered by a 1-H.P. motor. The machine illustrated is sound testing an automatic transmission helical pinion having sixteen teeth of 18 diametral pitch on a 1-inch pitch diameter and a width of 5/8 inch. The complete speeder inspection unit is about 66 inches high, 58 inches deep, and 108 inches wide.

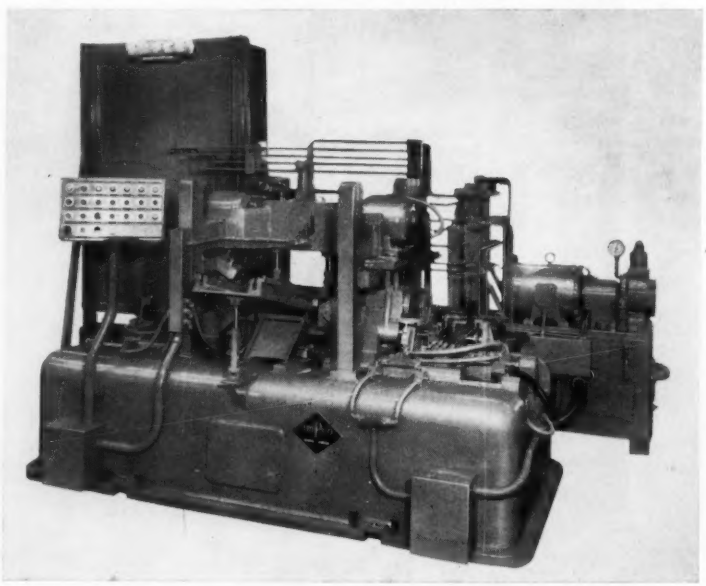
Circle Item 109 on postcard, page 229

Center-Lapping Machine

A completely automatic machine has been developed by the Industrial Metal Products Corporation, Lansing, Mich., for center-lapping a variety of parts manufactured on a high-production basis. In operation, parts are fed from a conveyer to an inclined magazine loader, then set automatically in the work-holding fixture, hydraulically clamped, center-lapped on both ends, and ejected onto the unload track at the rate of 300 pieces per hour.

The new machine employs two "IMPCO" center-lapping units. Each is equipped with an automatic dresser which dresses the stone after each cycle, or as required, and resets itself to adjust for amount of stone removed. The units are also equipped with automatic control-panel lights that flash on when stones have been used to minimum length, and the machine has shut off and reset itself.

Circle Item 110 on postcard, page 229



Automatic center-lapping machine developed by Industrial Metal Products Corporation

Cincinnati Improved Universal Grinding Machines

Notable improvements in accuracy, versatility, and ease of operation for their 12-, 14-, and 18-inch Filmatic universal grinding machines have been announced by Cincinnati Grinders, Inc., Cincinnati, Ohio. The Filmatic bearings have multiple segments that support the grinding wheel spindle accurately and rigidly on high-pressure, wedge-shaped films of oil. These bearings are self-adjusting for heavy roughing cuts or light finishing cuts. An automatic cut-out serves to stop the spindle drive motor should the lubricating system fail. The 12-inch machines have a 3-H.P. motor, while the 14- and 18-inch machines have 5-H.P. motors.

The hydraulic table feeds are infinitely variable from 3 to 240 inches per minute for 12-inch machines, and from 3 to 220 inches per minute for 14- and 18-inch machines. Table reversal may be automatically controlled from full rated stroke to as little as 3/32 inch, which produces an effect similar to that of a grinding wheel reciprocating attachment.

Accuracy of table reversal is within 0.004 inch. Table tarry at reversal is independently adjustable at each end of the stroke from 0 to 5 seconds. Hand-traverse of the table provides a fast movement of 1 inch per revolution of the handwheel for set-up purposes and a slow movement of 0.2 inch per revolution for fine adjustments and for shoulder grinding.

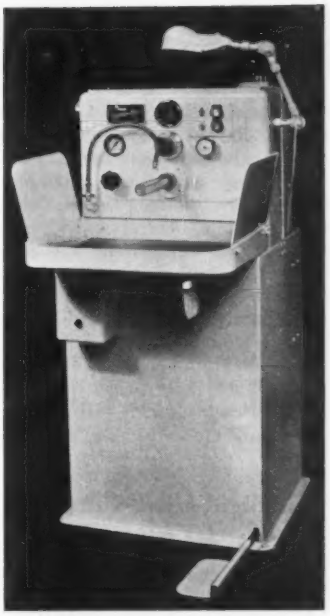
A two-speed handwheel provides 0.250 inch cross movement per revolution of the handwheel in fast feed and 0.050 inch per revolution in slow feed. Minimum cross-feed adjustment is 0.0000025 inch. Automatic pickfeed at table reversal is hydraulically actuated and infinitely variable from 0.0002 to 0.005 inch on the diameter in the low cross-feed range and 0.0005 to 0.0125 inch in the high range.

Headstock spindle speeds are infinitely variable from 55 to 550 R.P.M. for 12-inch machines and 22 to 225 or 40 to 360 R.P.M. for 14- and 18-inch machines. The headstock can be swiveled 30 degrees away from the wheel-head or 90 degrees toward the wheel-head for face grinding operations.

A hinged type internal grinding attachment is mounted on the front of the wheel-head where it can be swung up out of the way for conventional grinding operations or instantly swung down into position for internal grinding.

The electrical push-buttons and selector switches are conveniently grouped to facilitate identification and operation. The table starting lever automatically starts and stops the work rotation and the flow of cutting fluid. Net weight of the machines varies from 6100 to 10,900 pounds.

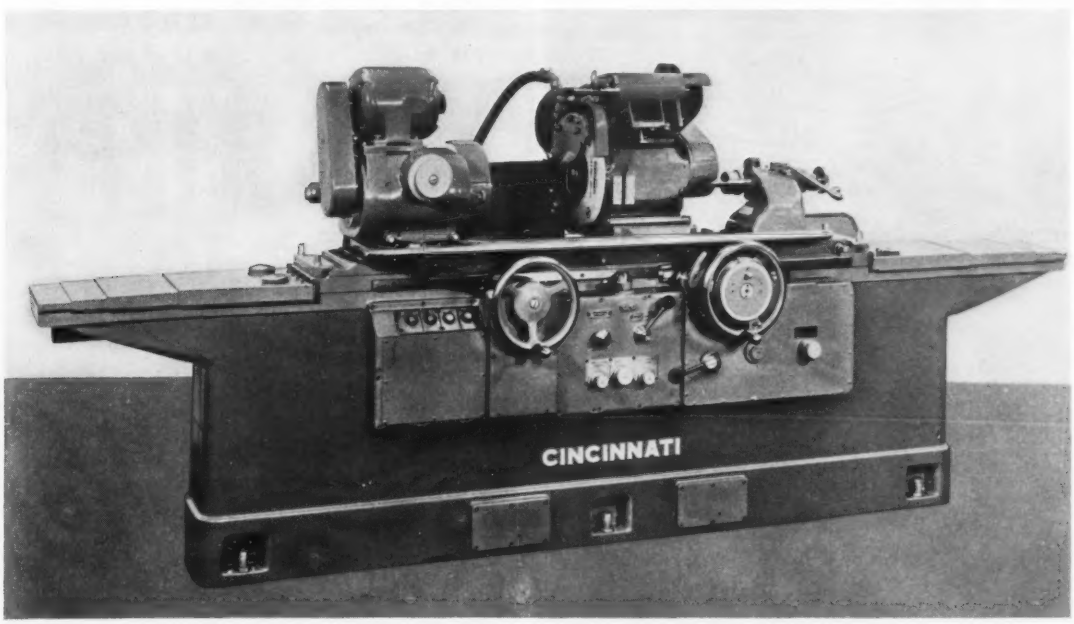
Circle Item 111 on postcard, page 229



Honing machine introduced by Superior Hone Corporation

Honing Machine with Constant Pressure System

A hydraulic system which assures constant pressure on the honing stone is a feature of the Model H. M. "Honemaster" brought out by the Superior Hone Corporation, Elkhart, Ind. Pressure control on the honing



Universal grinding machine of improved line built by Cincinnati Grinders, Inc.

stone is adjustable to suit the diameter of the piece and material being honed. Stone wear or stock removal causes no reduction of pressure, so that constant cutting action is assured. The hydraulic system also operates the clutch and brake.

The single-control sizing-dial indicator is set by honing the first piece to finish size. Thereafter, it is only necessary to compensate for stone wear. The sizing dial indicates when the piece is approaching the desired size. The spindle speed is infinitely variable from 100 to 900 R.P.M. and is indicated by an easily read tachometer. The spindle has a hardened pilot bushing.

Circle Item 112 on postcard, page 229

Sheffield Micro-Hardness Tester

A combination micro-hardness tester and metallurgical microscope, of non-destructive type, with a load-weight range of from 25 to 1000 grams, which requires only one minute for a complete test cycle, has been announced by the Sheffield Corporation, Dayton, Ohio. Interchangeable vise accessories permit this instrument to be used for testing small precision ground or lapped parts, small diameter wires, very thin materials, or material coatings, thin sheet stock, cutting tool edges, and ball bearings. It is intended for shop as well as laboratory use and can be operated easily and rapidly. A green light in the head of the instrument shows when the indenter is in contact with the work, and a red light indicates when the load cycle is complete.

Vertical capacity is 2 3/8 inches, and the maximum spread of the standard vise jaws is 1 11/16 inches. Surface finishes of 40 micro-inches r.m.s. or less can be inspected, and indentations of 0.0004 inch or smaller can be measured to within an accuracy of 0.00008 inch. The spot to be indented can be located within accuracy limits of 0.0002 inch.

The work-piece is raised to the indenter by a handwheel. A specially designed loading system, with the load applied in a direct vertical motion perpendicular to the work, eliminates indenter side thrust and deformed indentations which might cause incorrect reading of the hardness value. When the instrument is used as a metallurgical microscope, the interchangeable objective lenses provide magnifications of 200X and 400X. A camera can be attached to the eyepiece for making photomicrographs.

Circle Item 113 on postcard, page 229

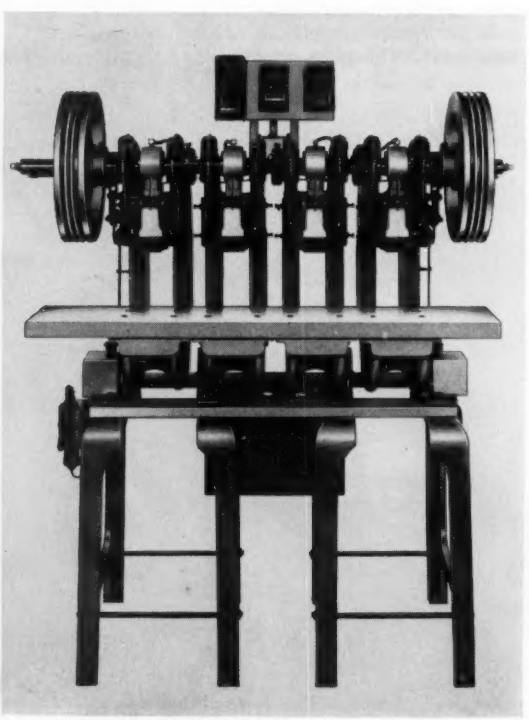
Benchmaster Multiple-Ram Press

The Benchmaster Mfg. Co., Gardena, Calif., is producing a series of multiple-ram presses especially designed to supply a large bed area for multiple-die operations where only moderate tonnage is required per die stage. Exceptional versatility results from this arrangement, since any required number of rams can be supplied in tandem, each performing one operation in a progressive set-up. The press will handle work ordinarily requiring the use of much higher tonnage presses to obtain the necessary bed area, thus reducing machine, tool, and maintenance costs.

On progressive die jobs, dies are made in separate stages, each stage operating on its own ram. Where frequent sharpening is required, or where dies are subject to breakage hazards, duplicate dies are kept on hand for immediate replacement, making possible almost continuous press operation and lowering risks of damage to other die components.

All machines in the tandem unit operate on a single common crankshaft. The ram strokes can be of uniform length or varied to suit requirements, thus accommodating shearing, piercing, bending, forming,

Micro-hardness tester made by Sheffield Corporation



Multiple-ram press made by the Benchmaster Mfg. Co.

and similar operations in the same line with maximum efficiency. Ram travel is always synchronous—rams descend simultaneously, alternately, or at staggered intervals depending on crankshaft design. If slower strokes are required, back-gear drives can be furnished. The press illustrated, with electrical clutch control, permits single tripping to check each set-up stage, or it can be run continuously with individual electrical switch-button control. A safety control button simultaneously stops motors and rams. One-shot lubrication automatically reaches all wear points of all presses.

These multiple-ram presses can be supplied with any frame spacing for intermediate operations of any nature and with 2-, 5-, or 8-ton units, plain or back-geared. All members of the tandem presses, however, must be of the same tonnage rating.

Circle Item 114 on postcard, page 229

Pneumatic Slide Feed for Small Punch Presses

An air-operated slide feed with open throat for fast automatic feeding on small punch presses has been announced by Cooper Weymouth, Inc., Bridgeport, Conn. Because of its small size and light weight, this feed can easily be moved from press to press or it can be left mounted on die sets ready for use on repeat orders.

Operation of the feed is by means of the shop air line, at pressures of 50 to 100 pounds per square inch. It takes material up to a maximum thickness of 1/16 inch and maximum width of 6 inches in the lighter gages. The maximum feed length is 3 inches, operating at 200 strokes per minute. Correspondingly higher speeds can be used when shorter feed lengths are employed.

While the feed operates off the press crankshaft, the length of the press stroke does not affect the feed length. Other features are: a feed-finger that has a larger stock-gripping surface than many larger mechanical feeds yet leaves the material unmarked; cushioned stops; roller stock guides; and a unique locking action of the rear gripping unit that prevents overriding and buckling of the stock.

Circle Item 115 on postcard, page 229

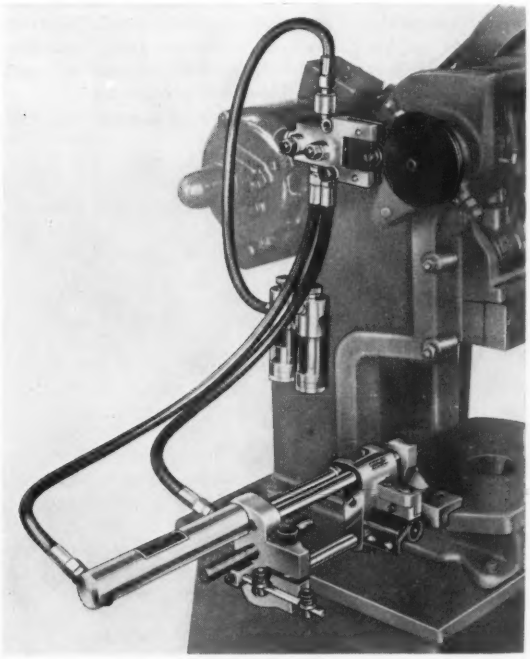
"Sever-All" Oscillating Cut-Off Machine

A high-speed, dry-abrasive cutting machine, designated Model 28 "Sever-All," of heavier construction than previous models has been brought out by the Campbell Machine Division, American Chain & Cable Co., Inc., Bridgeport, Conn. This machine will handle solid steels up to 4 inches square, 6-inch angles, and 8-inch channels, taking cuts at 90 degrees to the axis. These specifications are based upon using an 18-inch diameter Allison abrasive cutting wheel, a 10-H.P. motor, and a spindle speed of 2450 R.P.M. The machine is available in both stationary and portable models for cutting sheets, angles, channels, pipes, bar stock, and tubes.

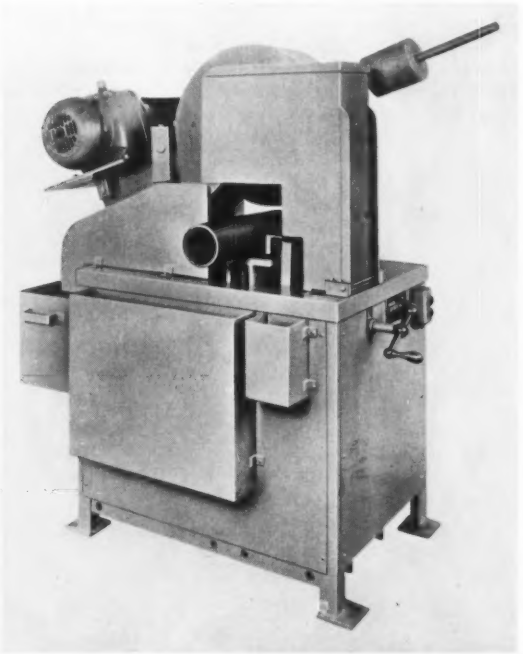
In this oscillating type unit, the wheel and work are fed manually. With oscillation, the amount of abrasive wheel contact is reduced and cutting is performed with a minimum of pressure on the wheel. A double-acting work-holder automatically positions the material being cut in the center of the support, and is clamped at both sides by a hand-operated crank handle.

Steel guards totally enclose the cutting wheel during operation, except for openings on the sides to clear the work. This extremely rugged machine measures 56 inches front to back, 32 inches left to right, and is 62 inches high. The net weight without electrical equipment and accessories is 1200 pounds, and the approximate weight with electrical equipment is 1400 pounds.

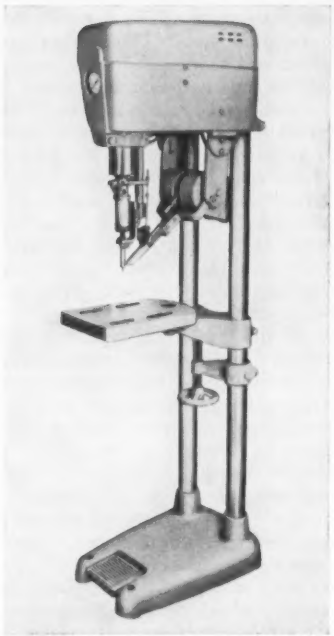
Circle Item 116 on postcard, page 229



Pneumatic slide feed for small presses brought out by Cooper Weymouth, Inc.



Oscillating, dry-abrasive cut-off machine announced by American Chain & Cable Co., Inc.



Shakeproof power screwdriver of versatile design

Power Screwdriver

A Model 400 power screwdriver that can be operator-controlled for certain work and converted to fully automatic operation when required is being manufactured by the Shakeproof Division, Illinois Tool Works, Chicago, Ill.

In a fully automated operation, this machine performs all of the functions ordinarily assigned to the operator, including feeding and guiding the screws, controlling the length of the stroke, and automatically maintaining a predetermined torque. Several of these machines can be set up to do multiple fastening jobs with only one operator controlling the entire battery.

The power screwdriver can drive as many as sixty screws per minute. In addition to achieving this high production rate, it is claimed that the machine reduces scrap loss and product damage, and is adaptable to many unusual operations. The motor, pulleys, drive belts, drive mechanism for the extra-large oscillating hopper, and other operating parts are enclosed in the streamline crown housing to protect them from dirt and damage.

Circle Item 117 on postcard, page 229

Multi-Max Presses Equipped with Air-Operated Clutch and Brake

An air clutch and air brake are now available on the line of Multi-Max punch presses built by the Diamond Machine Tool Co., Pico, Calif. The No. 5036 press with a bed 15 1/2 by 36 inches, ram 10 by 36 inches with 2-inch stroke, shut die height of 24 inches, and capacity of 50 tons is shown in the illustration with the air clutch and brake attached. The air clutch has a safety feature which prevents double tripping and gives the press operator the advantage of being able to employ an inching operation when setting up the press or making adjustments.

The ram is operated at a slow travel rate and can be stopped in any predetermined position while setting the dies. With the air clutch, it is practical to use a variable-speed motor in synchronizing the speed of the press with a conveyor belt or feeding mechanism. The air brake, when used with an air clutch, is completely free from drag, eliminating heat and excessive consumption of power. It is timed to apply pressure for a very small fraction of the press stroke at the exact moment the clutch is disengaged.

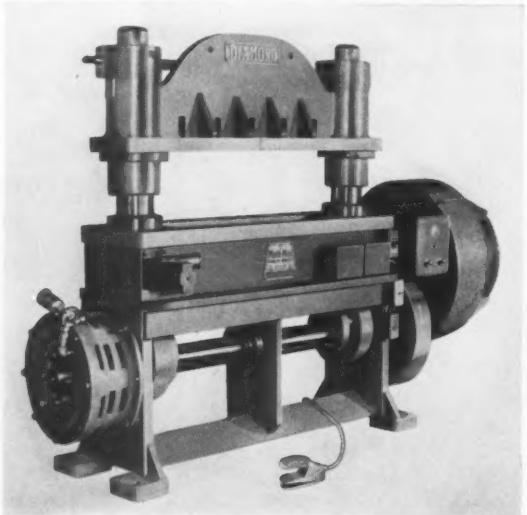
Circle Item 118 on postcard, page 229

Tumbling Barrel with Power Tilt Feature

The Model DM-PT series is the newest in the line of tumbling barrel equipment manufactured by the Globe Division, Casalbi Co., Jackson, Mich. The Model DM is especially designed for versatility and operator convenience. The power tilt feature provides for easy loading, rinsing, and unloading. Push-button control starts, stops, and regulates up and down movement of the tumbling barrel.

The cubical content ranges upward to 23 cubic feet and the maximum load capacity of the largest model is 1500 pounds. Five models are available with round, octagonal, or flask type shells, made of hard maple or steel (with or without neoprene lining). Optional electrical equipment meets J.I.C. specifications. All models are available with variable-speed motor.

Circle Item 119 on postcard, page 229



"Multi-Max" press with air-operated clutch and brake

Globe tumbling barrel with power tilting mechanism

Dumore "Micro-Drill" for precision multiple-hole drilling

Dumore Precision "Micro-Drill"

A precision "Micro-Drill," developed to speed up difficult micro-hole drilling operations, has been announced by the Dumore Co., Racine, Wis. It is claimed that unskilled workers can learn to operate this drill in only a few minutes. A magnetic chuck and collets of unique design take most commercially available micro-drills with shanks 0.030, 0.040, and 0.061 inch in diameter. Two magnetic drivers, which fit into the chuck, accommodate drills 0.001 to 0.006 inch and 0.007 to 0.020 inch in diameter.

A drill selected for use is inserted in the collet and placed against the magnetic driver which holds these members in the drilling position. Run-out is corrected instantly by truing with a pencil or fingernail. A calibrated micrometer depth control device employing a knurled feed-ring provides a positive stop within 0.0002 inch of the exact depth specified. It also eliminates drill breakage by regulating the feed to a few thousandths of an inch or less at each pass of the drill.

Another outstanding feature is the two-way table travel provided as standard, built-in equipment on the multiple-hole "Micro-Drill" unit. It eliminates set-up time between hole-drilling operations and removes the necessity for providing special tools and fixtures. Table travel is adjustable from zero to 1 1/8 inches, both front to back and side to side. Two large, easily read dials indicate travel which is controlled by convenient knobs for quick location and exact spacing between holes.

An adjustable auto-transformer for voltage control provides for the relatively low speeds of 2000 R.P.M. and under required for micro-hole drilling. A ten-power viewer and spotlight pinpoint the work, giving full, clear vision on the smallest holes. Motor speed is adjustable from zero to 17,000 R.P.M. and permits the selection of the correct speed for any drill size up to 1/8 inch in diameter.

The multiple-hole "Micro-Drill" is recommended for use in drilling spinnerettes, instrument work, fuel nozzles, watch and jewelry work, aircraft parts, and other uses where small holes are essential. A single-hole "Micro-Drill" unit with stationary table is also available.

Circle Item 120 on postcard, page 229

Man-Au-Cycle Automatic Threading Lathe

The Man-Au-Cycle Corporation of America, Brooklyn, N. Y., recently introduced a Model 1240 automatic threading lathe. This high-speed, single-point thread-cutting machine automatically cuts internal and external threads of right- and left-hand taper and multi-start types.

The new model is approximately 1000 pounds heavier than previous models and is equipped with a secondary gear-box for producing multi-start threads automatically. It also features a multi-feed attachment which enables the operator to automatically duplicate 2, 3, 4, or 6 passes when cutting multi-start threads.

Another feature is a pressure indicator which is built into the live center of the tailstock. This allows the operator to determine tool pressure and heat distortion at a glance. Like previous models, this lathe has a capacity for cutting threads up to 55 inches in length and will swing work up to 12 inches in diameter.

The operator has only to load, unload, and start the automatic cycle. The machine is set for a predetermined number of passes up to 100 per minute. High working speeds, up to 2000 R.P.M., permit full utilization of carbide tools.

Circle Item 121 on postcard, page 229

Giant-Size Metal-Cutting Band Saw

W. F. Wells & Sons, Three Rivers, Mich., have brought out a giant-size, metal band saw designated Special Model-J which can be engineered to meet individual specifications. This saw has a capacity for cutting round stock up to 38 inches in diameter or 38-inch square bars.

Automatic threading lathe introduced by the Man-Au-Cycle Corporation of America

A 3-H.P. motor drives the blade on four wheels at speeds of 2000, 1500, and 1000 surface feet per minute for cutting carbon, aluminum, magnesium, and brass. Other speeds are available for cutting a variety of materials. The machine can be raised hydraulically on two posts. A push-button-controlled hydraulic pump unit and all electrical switches are enclosed by a dustproof control panel.

Circle Item 122 on postcard, page 229

Triple Action Cutting Barrel

The Hartford Steel Ball Co., Hartford, Conn., has added to its line of triple action cutting barrels two fully enclosed models with capacities of 10 and 4 cubic feet. These models are said to speed deburring, descaling, and polishing operations on screw machine parts, stampings, and castings. Parts can be quickly and economically processed by any tumbling method, using the abrasive chip process, ball and steel shape process, branded compounds, or other medium for special jobs.

The power unit is located on top of the machine for long life, cleanliness, ease of maintenance, and compactness. Equipment includes drum type reversing switch; 24-hour program timer that can be set for any cycle from 15 minutes to 24 hours; magnetic starter and brake which permit inching of barrel into loading and unloading positions; tilt-back front safety guard; and improved four-speed gear shift control.

Optional features include single speed or fully variable speed drives; and a hollow shaft with rotary pressure joint that permits permanent water connections for faster filling and flushing of barrel. These models can also be supplied with neoprene-lined barrels. A pressure vent in cover is provided for safety.

Circle Item 123 on postcard, page 229

Static Balancing Machines

The Balance Engineering Co., Chicago, Ill., has added two vertical static balancing machines to its line of "Beko" static and dynamic balancers. The Model 201-VL has weight capacities of 1 to 20 pounds and will handle work having diameters up to 20 inches. The Model 201-VH will handle work weighing from 5 to 75 pounds with diameters up to 20 inches. These machines can be used by unskilled operators for balancing impellers, blower wheels, flywheels, fans, pulleys, and other parts having no integral shaft.

Magnitudes of unbalance are positively indicated by a large, easy-to-read meter calibrated directly in terms of unbalance correction for the procedure selected. Angular positions are accurately pointed out by a stroboscopic lamp as a location for the removal or addition of weight.

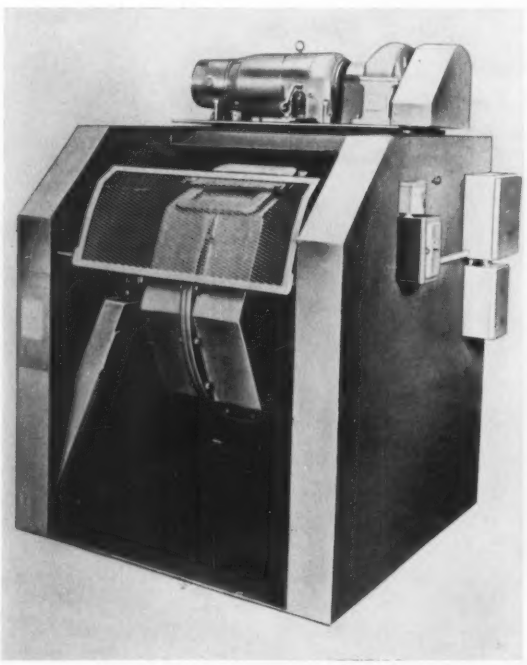
Circle Item 124 on postcard, page 229

Kaufman Tapping Head

A tapping head, designed to produce accurate male or female threads with a minimum of maintenance or set-up time, has been announced by the Kaufman Mfg. Co., Manitowoc, Wis. The head column and table units of this equipment are ruggedly constructed to insure a minimum amount of deflection, regardless of the size of the job being handled. The torque control, with a change of setting, will provide safe driving of a 3/8-inch or a 2-inch pipe tap, or it can be set for sensitive driving of a 5/8-inch UNC or a 2-inch UNC tap.

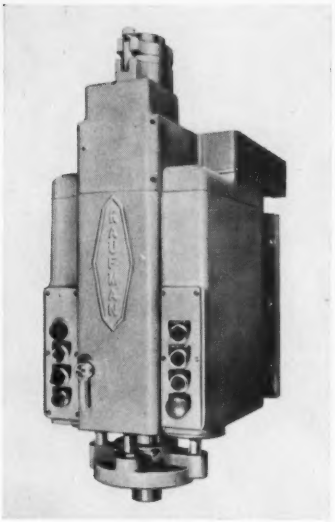
This 101 series tapper is said to have more operating, control, and production features than have previously been available in a single tapping head. It can be mounted vertically or horizontally and can be arranged in combinations to perform two or more operations. Also, it can be mounted horizontally or angularly in combination with vertical heads to do various operations simultaneously.

Other features include: an extremely sensitive torque control which signals when overloading oc-



Hartford fully enclosed triple action cutting barrel

Balancing machine made by the Balance Engineering Co.



Tapping head brought out by the Kaufman Mfg. Co.

curs and stops the machine automatically to avoid tap breakage; a pressure lubricated lead-screw; positive precision depth control; air-operated clutch with instant reversal; a simple non-reversing motor drive; and spindle speeds ranging from 35 to 785 R.P.M.

The same head can be furnished for drilling and reaming. Machines arranged for two or more consecutive operations can also be furnished in combination with an indexing fixture, mounted on a base to suit the job. The unit construction of these machines readily adapts them for horizontal or angular work or for use in combination with vertical heads for performing various operations simultaneously.

Circle Item 125 on postcard, page 229

Engelberg Conveyor Type Belt Grinder

An abrasive-belt machine of the contact wheel type, arranged to perform four grinding operations simultaneously, is being manufactured by the Engelberg Huller Co., Syracuse, N. Y. This four-head Model 680-4 belt grinder is designed for high-volume flat surfacing of ferrous and non-ferrous metals, glass, plastics, ceramics, and other materials. It produces extremely fine micro-inch finishes to exacting tolerances and makes possible a single-cycle operation from rough to polished part.

A typical multiple grinding sequence, using a series of progressively finer belts, is: rough grind, perform two semi-finishing operations, and finish grind. One pass under the four heads can remove approximately 0.020 inch of steel stock and up to 0.060 inch of stock from other materials. The machine is applicable to both wet- and dry-belt grinding, a cooling unit equipped with 1/2-H.P. pump having a capacity of 100 gallons being provided for wet grinding.

The machine is particularly adaptable to automatic production lines. Parts can be handled by conveyors for presentation to the conveyor belt of the machine, automatically ejected, and carried to the machine which performs the next operation. The machine conveyor belt is 6 1/2 inches wide. Quick manual adjustment of the conveyor belt speed is obtainable in a range of from 2 to 25 feet per minute.

The abrasive belt is 6 by 80 inches, and the abrasive belt speed of individual heads is constant at 5500 surface feet per minute. Belt tension is easily adjustable. Work up to 5 inches high, 6 inches wide, and of any length can be handled. The machine is 125 inches long, 51 inches wide, 90 inches high, and weighs 5500 pounds. Heads have either 5- or 7 1/2-H.P. drives, and the machine can be modified for five- or six-head applications. Magnetic chucks are optional.

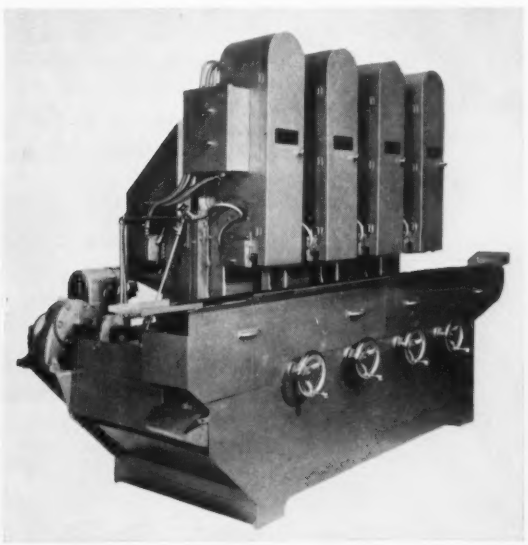
Circle Item 126 on postcard, page 229

Bench Type Arbor Press

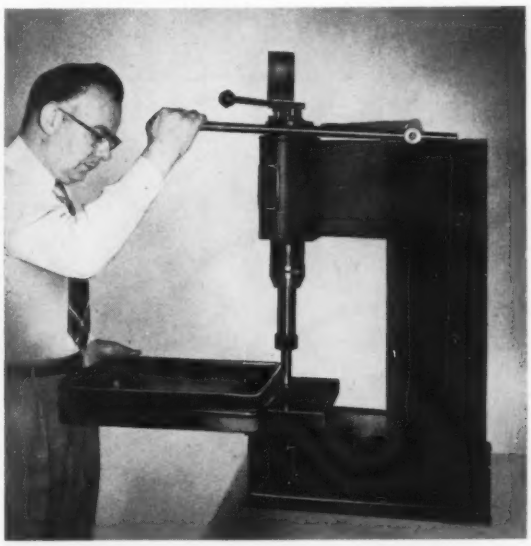
K. R. Wilson, Inc., Arcade, N. Y., has announced a compact low-cost bench type press designed to perform various types of operations including bending, straightening, marking, and punching. It can also be adapted for removing and replacing gears, bearings, and bushings on motor shafts and other equipment. This press is equipped with the manufacturer's patented release valve designed for "finger tip" ram control. The completely self-contained hydraulic cylinder provides for a ram stroke of 6 3/4 inches. Maximum daylight opening is 12 inches.

Circle Item 127 on postcard, page 229

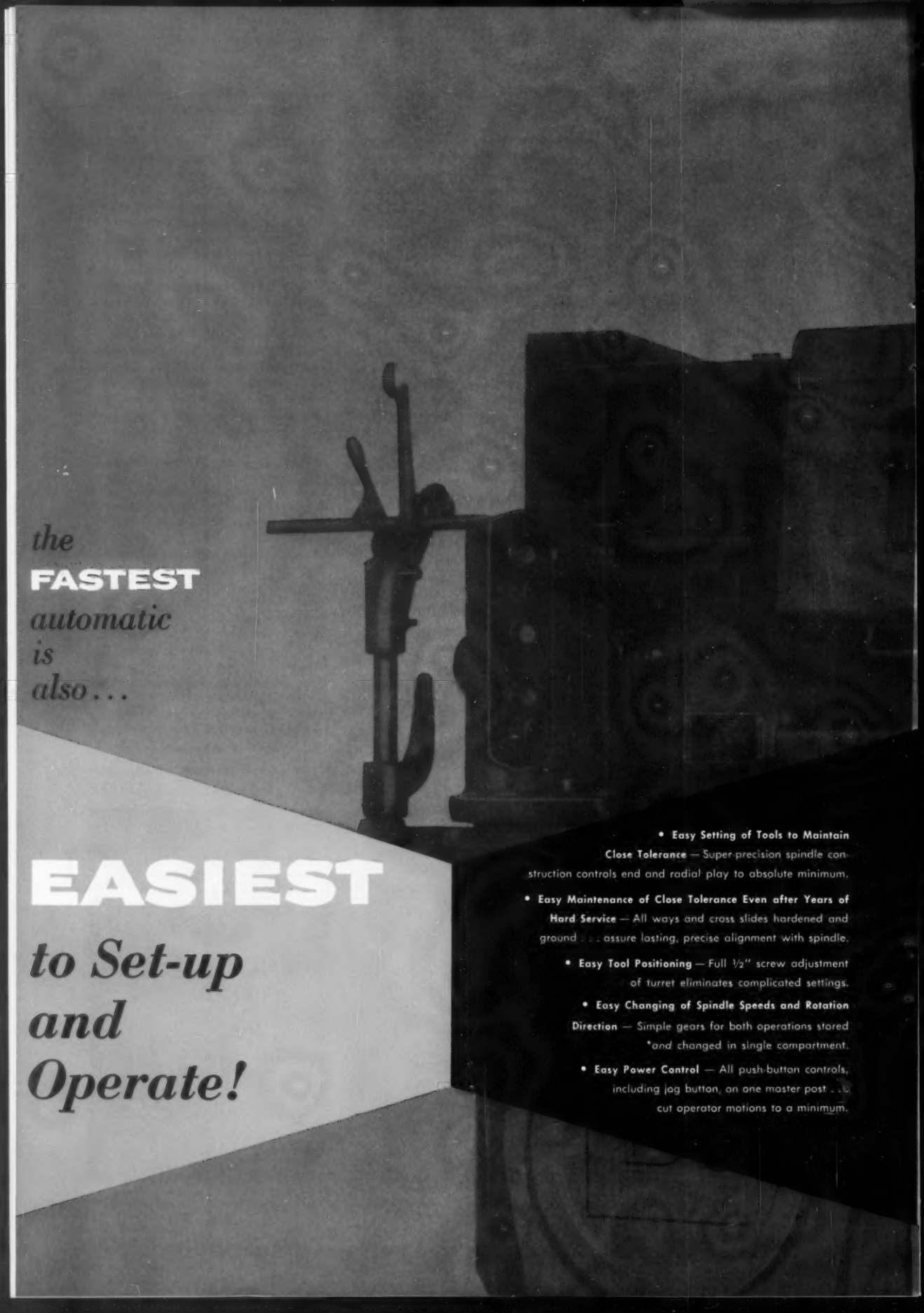
(This section continued on page 218)



Abrasive belt grinder made by the Engelberg Huller Co.



Wilson hydraulically operated bench type arbor press



the
FASTEST
automatic
is
also . . .

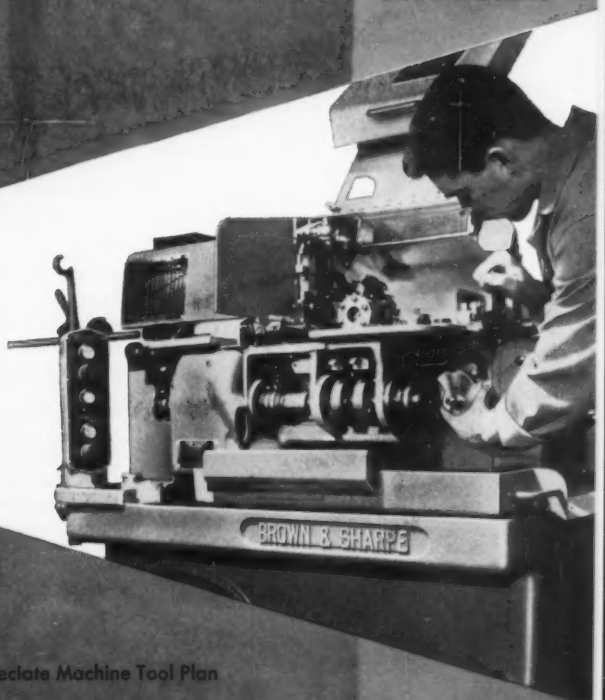
EASIEST

to Set-up and Operate!

- **Easy Setting of Tools to Maintain Close Tolerance** — Super-precision spindle construction controls end and radial play to absolute minimum.
- **Easy Maintenance of Close Tolerance Even after Years of Hard Service** — All ways and cross slides hardened and ground . . . assure lasting, precise alignment with spindle.
- **Easy Tool Positioning** — Full ½" screw adjustment of turret eliminates complicated settings.
- **Easy Changing of Spindle Speeds and Rotation Direction** — Simple gears for both operations stored and changed in single compartment.
- **Easy Power Control** — All push-button controls, including jog button, on one master post . . . cut operator motions to a minimum.

Brown & Sharpe
No. 00 Automatic
Screw Machine

That's right! The fastest automatic on the market also holds the record for ease of set-up and operation! In fact, the Brown & Sharpe No. 00 Automatic Screw Machine provides a unique combination of high speed, easy operation, and low maintenance that steps up overall efficiency as much as 33⅓%! Push-button controlled, modern in every detail, it's the truly advanced automatic for turning, forming, one-chip finishing to 0.0005". Only a few of its time-saving features are listed on these pages. Write for full details. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.



Ask about Our Pay-as-You-Depreciate Machine Tool Plan

Brown & Sharpe B&S

Fig. 1. Precision hole borer, made by the Canton Tool Mfg. Co.

Precision Drilling and Boring Machine

The Canton Tool Mfg. Co., East Canton, Ohio, has announced a new precision hole borer designed for exceptionally rapid center-drilling, drilling, and boring operations on repetitive production work. This machine is said to hold bore sizes and hole spacing within accuracy limits of 0.0001 inch.

A master or template is produced with standard size holes that locate the positions of all the desired finished holes. The template, as shown in Fig. 2, is mounted on the under side of a fixture which holds the work-piece. A disappearing locating pin, in exact alignment with the spindle, engages each hole in the template, so that the master piece can be reproduced exactly. Time-consuming set-up and alignment of each part is thus eliminated. The precision hole borer handles a wide range of parts and hole requirements. Complete lines of boring bars, collets, drill chucks, and facing heads are available.

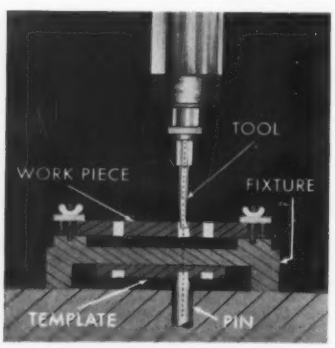
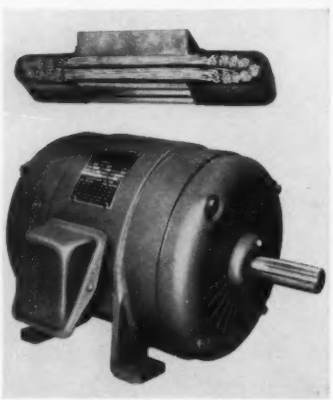


Fig. 2. Diagram showing new principle used in Canton Tool's precision hole borer

Circle Item 128 on postcard, page 229

Motors with Extruded Plastic Insulation

The Lincoln Electric Co., Cleveland, Ohio, has announced its reentry into the electric motor manufacturing field with the introduction of a new line of "Linc-Weld" motors. These motors have a unique extruded plastic insulation. They are now available in sizes from 1 to 40 H.P. and are built in the open type frame and torque design B to comply with N.E.M.A. specifications.

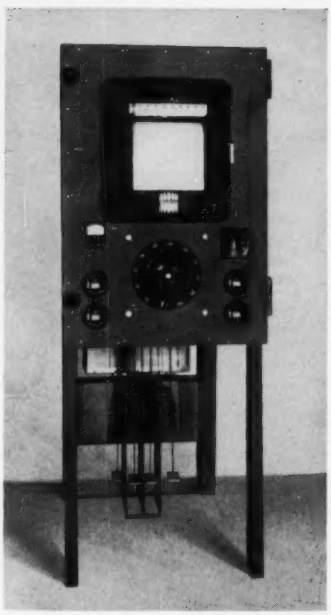


"Linc-Weld" motor completely encases windings and individual wire as shown in cross-section view

The thermosetting plastic insulation is molded into and around the stator windings, the stator being placed in a die and the plastic material forced into the die under the proper heat and pressure. The liquid plastic resin is extruded through the stator slots, completely covering the winding. After the plastic resin "sets," the stator is removed from the die. The result is a motor winding that is encased in a rigid, tough, and durable mass, as shown in the cross-section view of the accompanying illustration.

Extensive tests have shown the plastic to be resistant to chemical action, humidity, abrasive dust, lint, and oil vapor.

Circle Item 129 on postcard, page 229



Baldwin-Lima-Hamilton multiple creep rupture testing machine

Multiple Creep Rupture Testing Machine

A multiple creep rupture testing machine of the lever type in which four specimens can be held simultaneously under loads up to 4000 pounds is announced by Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. A special four-specimen electric furnace under automatic temperature control by a single-point indicating and recording controller will hold specimens at any temperature up to 1800 degrees F. A Variac voltage adjuster of 7 K.V.A. capacity is used for furnace control. Running time counters totalize up to 10,000 hours in 0.1-hour intervals. Extensometers can be used on specimens if desired.

A compound lever system gives a load ratio of 50 to 1. Specimens can be loaded in increments of 5 pounds. A feature of the creep machine is a dashpot in each of the lever systems which prevents transmitting shock and recoil from a breaking specimen to other specimens under test. Machines can be placed side by side, since access is required only at front and rear. Furnace and grip assemblies are at the front of the machine, while the controls and recorder are on a rear panel. Test bar grips have heads 3/4 inch in diameter and shanks 1/2 inch in diameter.

Circle Item 130 on postcard, page 229

(This section continued on page 220)

CINCINNATI
BICKFORD
SUPER SERVICE
Radials

For faster metal drilling . . .

This ultra-modern head . . . CHARTS and PRE-SELECTS PROPER SPEEDS and FEEDS

You chart, you control, you speed up operations and have a record for reference with this advanced head. The prescheduling chart plans sequence of operations and is a complete guide for the operator. Instant, quiet, hydraulic selection and changes of 36 speeds and 18 feeds are preselected by two convenient, easily read dials. Controls for clamping of column, arm and head, and arm elevation by power are at the operator's finger tips.

Built in 4 foot to 8 foot arm, 13 inch to 19 inch column. Spindle speeds may be as low as 8 RPM or as fast as 1750 RPM.

Write for Bulletin R-33 describing this ultra-modern tool

CINCINNATI BICKFORD

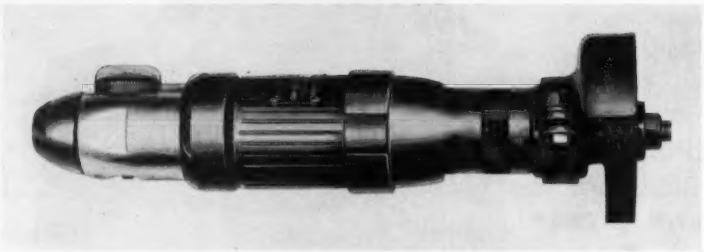
SUPER C B SERVICE

RADIAL AND UPRIGHT DRILLING MACHINES

CINCINNATI BICKFORD DIVISION
GIDDINGS & LEWIS MACHINE TOOL COMPANY
OAKLEY, CINCINNATI 9, OHIO, U.S.A.

Thor Series of Air-Operated Rotary Grinders

A new series of air-operated rotary grinders, with double the power of the models they replace, has been announced by the Thor Power Tool Co., Aurora, Ill. Two models, the 3G and the 3GE, are the first units in the new No. 3 series. They replace the No. 10 series grinders as well as the OOH model. These streamline grinders are light in weight and designed for a wide variety of industrial uses.



Thor 3G air-operated rotary grinder with automatic head oiler, built-in muffler, and adjustable governor

The 3G grinders will be available in five styles, based on motor speeds of 7, 10, 12, 15, and 18,000 R.P.M. The 3GE model will have a speed of 18,000 R.P.M. only, and feature a tapered extension spindle support which extends approximately 3 inches beyond the spindle of the 3G series. The 3G grinders are intended basically for precision work and for production grinding in factories, foundries, shops, and laboratories. They weigh less than 3 3/4 pounds, have an over-all length of 11 1/4 inches, and operate at their respective speeds on an air pressure of 90 pounds per square inch. They are equipped with 1/4-inch air inlet pipe threads, take a minimum hose size of 3/8 inch, and feature a thumb-twist throttle for sensitive control. The 7000-R.P.M. grinder takes a 3-inch vitrified wheel, and the 15,000- and 18,000-R.P.M. versions take 1 1/2-inch vitrified wheels.

Important features of the 3G grinders, in addition to the pronounced increase in power and the decreased weight, are a sharp reduction in the number of working parts and a 360-degree adjustable exhaust deflector. All parts, with the exception of the governor, are completely interchangeable. The attachments which can be used with the basic tools include mounted points, rotary files, steel cutters, soft felt and rubber polishers, and wire wheels.

Circle Item 131 on postcard, page 229

Wheelabrator Abrasive-Blast Cleaning Machine

A batch type airless abrasive-blast cleaning machine designed for efficient, economical operation has been introduced by the Wheelabrator Corporation, Mishawaka, Ind. This machine, known as the "Wheelabrator Super Tumblast," has an operating load capacity of 28 cubic feet. It is designed for removing sand, scale, oxides, and other contaminants from any work that can be tumbled.

The machine has been designed for maximum production and cost-free maintenance over extended periods of time and is said to be well adapted for automation installation.

A single super-capacity airless Wheelabrator blast unit throws 830 pounds of abrasive per minute, or more than twice the amount delivered by any wheel of similar size previously used. This makes it possible for the "Super Tumblast" to employ only one abrasive hurling wheel, whereas conventional machines of similar load capacity require two wheels. The abrasive shower delivered by the new super-capacity wheel spreads evenly over the cleaning chamber, resulting in rapid, uniform cleaning of the work.

Circle Item 132 on postcard, page 229

Bristol Automatic Hopper Feed for Set-Screws

A new device for automatic hopper feeding of standard socket set-screws is being manufactured by the Bristol Co., Waterbury, Conn. This

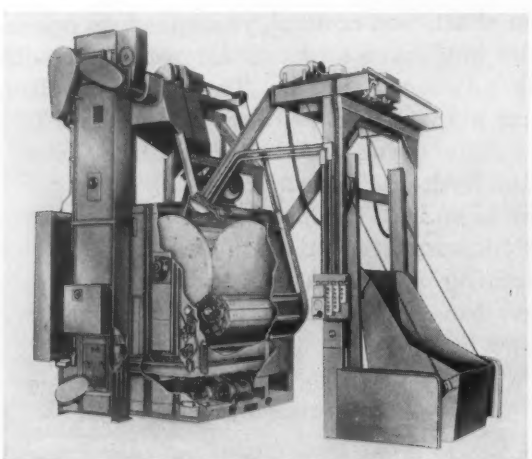


Fig. 1. Cut-away view of Wheelabrator "Super-Tumblast" cleaning machine

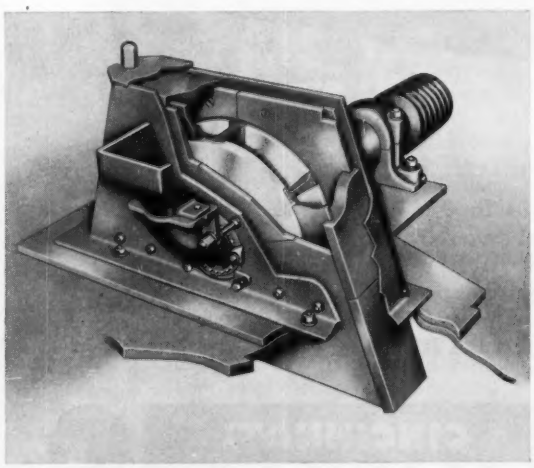


Fig. 2. Abrasive-hurling wheel of machine shown in Fig. 1 with enclosure cut away

THE SIDNEY MACHINE TOOL COMPANY
over 50 years of service to AMERICAN INDUSTRY
SIDNEY • OHIO

it's a
SIDNEY
HEAVY-DUTY LATHE

MAKING A SLEEVE FOR A TOOL GRINDING MACHINE . . .

AT

BELL AIRCRAFT
CORPORATION
IN
BUFFALO, NEW YORK

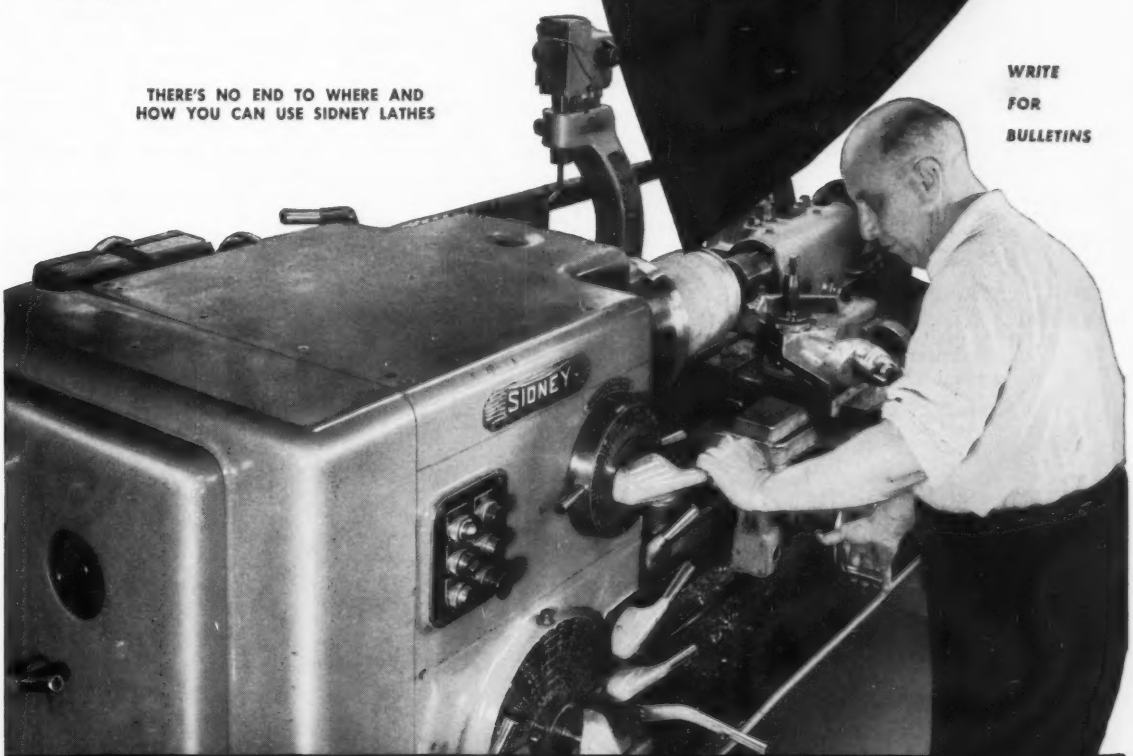
Operations like this are always interesting to concerns who need dependable, cost-cutting lathes for their own products or to build equipment for others.

For example, at Bell Aircraft, Buffalo, New York, this SIDNEY LATHE is making a sleeve for a tool grinding machine which will be used for grinding parts for their rocket engines. Naturally they need and get allowable tolerances of .001 (±) without any trouble.

Bell Aircraft also uses SIDNEY LATHES to machine gear cutters which are used in connection with their guided missile program.

THERE'S NO END TO WHERE AND HOW YOU CAN USE SIDNEY LATHES

WRITE FOR BULLETINS



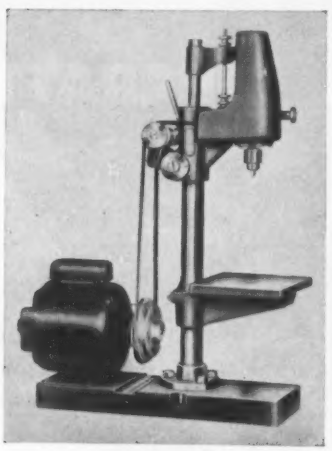
THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904

device automatically feeds and positions standard hexagonal or multiple-spline socket set-screws to automatic power screwdrivers. Feed rates up to 2700 per hour are possible, the rate being limited only by the speed at which the screwdriver can be operated.

The unit can be adjusted to feed socket set-screws of various sizes. Simple adjustments enable the operator to switch from one length to another, while it is only necessary to change a few feeder tubes to change from one diameter to another. Standard socket set-screws, without modification of thread, point, or socket end are handled by this feeder.

Circle Item 133 on postcard, page 229



High-speed drilling machine brought out by High Speed Hammer Co.

Sensitive Drilling Machine

The High Speed Hammer Co., Inc., Rochester, N.Y., has announced the general availability of its Class 8 sensitive drilling machine, previously made exclusively for the U. S. Government. This high-speed drill is available with two drives, giving spindle speed ranges of either 2450, 2815, 3080, and 3450 R.P.M. or 2450, 3630, 4810, and 6000 R.P.M. It drills to the center of a 6-inch circle, has a 9/16-inch diameter spindle, and a spindle feed of 2 1/4 inches. The maximum distance from chuck to base is 14 inches and from chuck to round table 9 1/2 inches. The drill occupies a bench space 7 by 19 inches, is 25 inches high, and will drill No. 80 to 1/4-inch holes.

The machine comes with 5 5/8-inch round table. An optional 6- by 8-inch rectangular table overlaps the base to form continuous work surfaces when set up in gangs. Standard equipment includes 110 volt, single-phase motor.

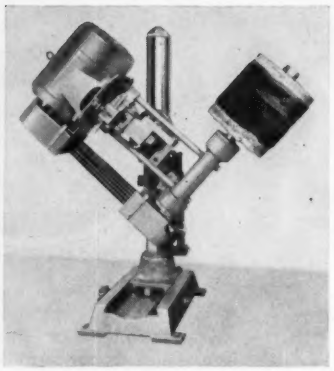
Circle Item 134 on postcard, page 229

Electric Arc Etching Attachment

Marking of extremely hard surfaces is made possible by a new tracer-guided electric arc etching unit manufactured by the New Hermes Engraving Machine Corporation, New York City, for use on their "Engravographs." This etching unit produces clean black identification markings of high legibility on tools and parts made of hardened steel.

The process has the advantage of eliminating the use of acids and their fumes. The marking of rounded surfaces, either convex or concave, as well as irregular contours is readily accomplished by the process which leaves no burrs. The unit, consisting of a transformer and an etching spindle, is available for Engravographs already in use.

Circle Item 135 on postcard, page 229



Murray-Way polisher with wide-face wheel

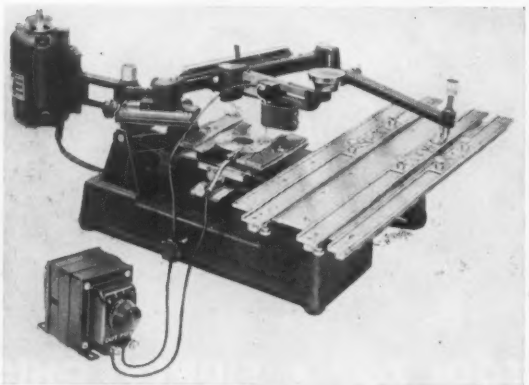
Polisher for Wide Work

The Murray-Way Corporation, Birmingham, Mich., has announced the development of a polisher with a wide-face polishing wheel. This unit, known as the No. 53, has built-in Murray-Way floating action and will handle work up to 24 inches in width. The floating action gives an even buffing and polishing over the entire work surface. It simplifies the positioning of the work-piece, and, once the proper pressure is established, hundreds of pieces can be uniformly processed. This polishing unit is available in two models—the No. 53 heavy-duty model illustrated and the No. 54, which is a smaller size unit.

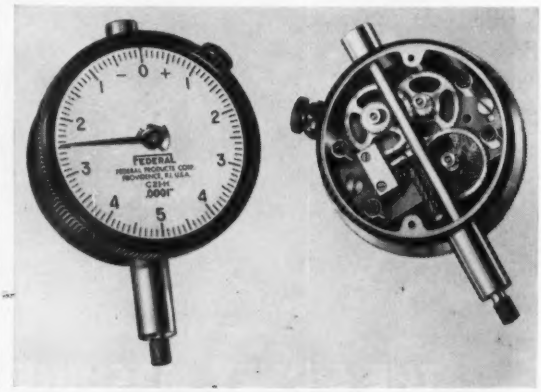
Circle Item 136 on postcard, page 229

Dial Indicator Designed for Hard Service

Federal Products Corporation, Providence, R. I., has developed a series of rugged, shockproof dial indicators. The gears, racks, and pin-

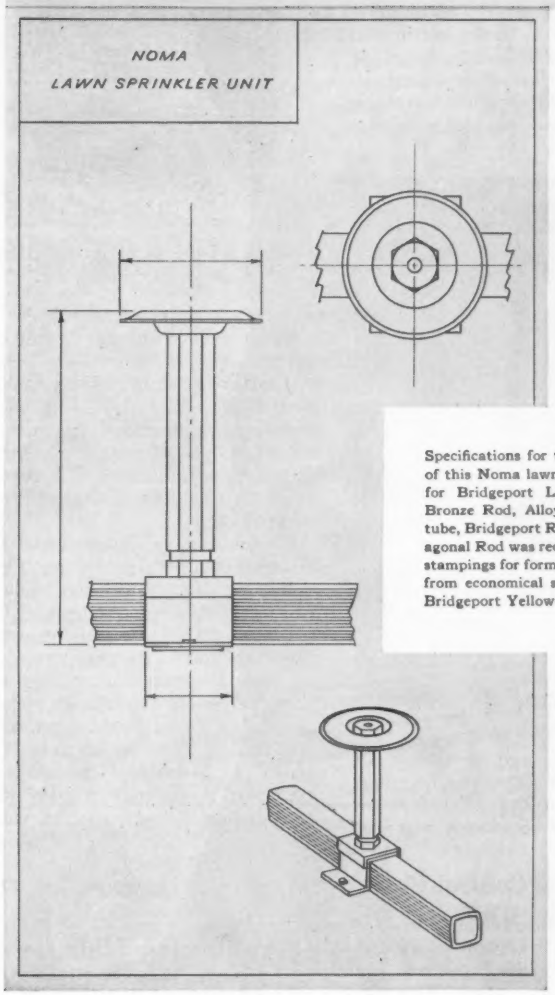


"Engravograph" made by New Hermes Engraving Machine Corporation equipped with electric etching attachment

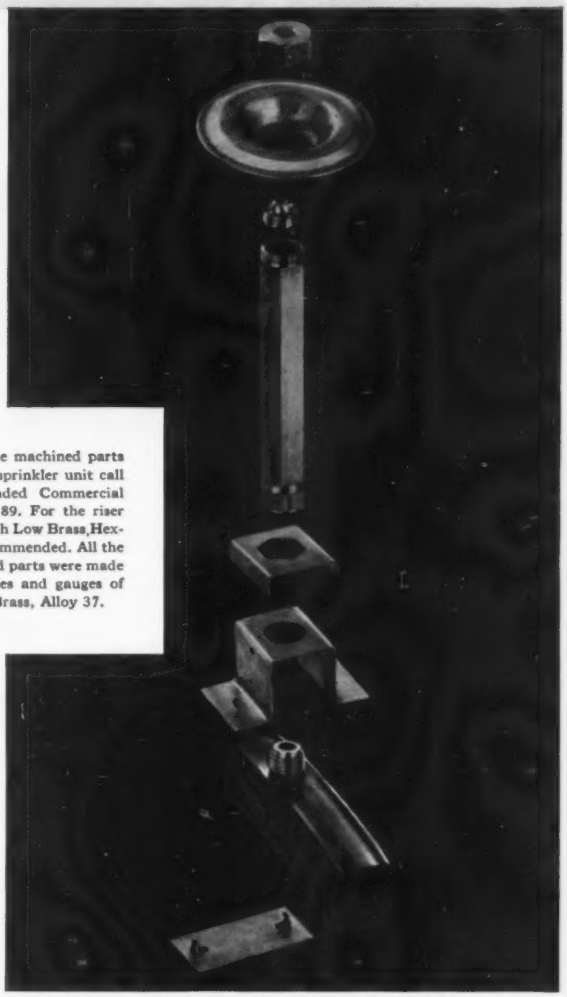


(Left) Face view of Federal dial indicator; (right) view of indicator mechanism

Matching metal to job with Bridgeport alloys



Specifications for the machined parts of this Noma lawn sprinkler unit call for Bridgeport Leaded Commercial Bronze Rod, Alloy 89. For the riser tube, Bridgeport Rich Low Brass, Hexagonal Rod was recommended. All the stampings for formed parts were made from economical sizes and gauges of Bridgeport Yellow Brass, Alloy 37.



Photos courtesy Noma Spray Division, Noma Lites, Inc.

Whether it's machined or formed—there's a Bridgeport HIGH I. Q.* Alloy to match the job!

Producing a lawn sprinkler unit such as this requires a variety of metalworking operations. Bridgeport High I.Q.* alloys can meet all the requirements of your operations because they are job-matched to each production step. Whether your products involve one or many components, you can profit by using Bridgeport alloys. Your nearest Bridgeport sales office will be glad to help you select the alloys best suited for your particular job.

**High Inner Quality*

BRASS Bridgeport CO.

BRIDGEPORT BRASS

Offices in Principal Cities • Conveniently Located Warehouses

Bridgeport Brass Company, Bridgeport 2, Connecticut • In Canada: Noranda Copper and Brass Limited, Montreal

For more information fill in page number on Inquiry Card, on page 229

ions of these indicators are all precision hardened. This insures greater durability for these vital parts, and practically eliminates the need for repairs.

Extensive tests, both in the laboratory and in the shop, are said to have proved that the hardened gear movement can stand 50 per cent more impact without damage than the conventional indicator movement. This not only minimizes maintenance costs but also makes a cushioned movement unnecessary. Internal friction has also been reduced from 16 to 25 per cent, giving longer life, higher sensitivity, and greater accuracy. Off-white light, green dials, and fine-line graduations facilitate accurate reading. The indicators are available in the four A.G.D. sizes, from 1 11/16 to 3 5/8 inches in diameter, as well as long-range and wetproof models.

Circle Item 137 on postcard, page 229

"Dearbornaire" Column Type Air Gaging Instrument

An improved, column type air gaging instrument, designed to provide greater accuracy, versatility, and longer life for the gaging element, is announced by the newly formed Air Gage Division of Dearborn Gage Co., Dearborn, Mich. Introduced under the trade name "Dearbornaire," the air gage, Fig. 1, incorporates several new features.

The instrument is available as a single- or multiple-column unit in standard amplifications of 1250 to 1, 2500 to 1, and 5000 to 1, or any combination thereof. For all three amplifications, "zero" is centered at midpoint on the calibrated scales for faster, more positive reading. When used for normal parts inspection, for example, all tolerances can be read "plus" or "minus." When using statistical quality control, values can be read directly. Further, with the zero-centered scales, these instruments can be used as tool setting gages.

A complete line of air gaging elements designed for interchangeable use on all three standard amplifications has also been developed. Included are air gage spindles, rings, snaps, and cartridges, Fig. 2.

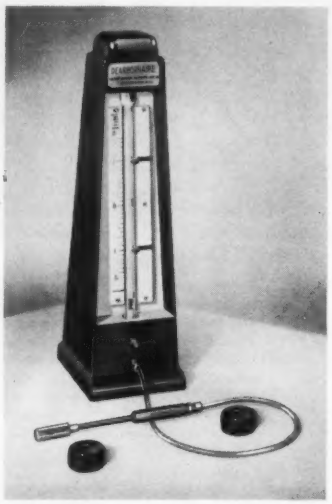
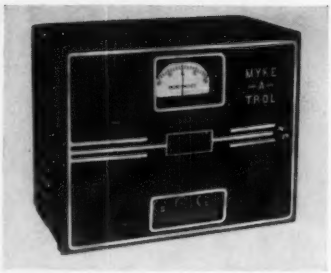


Fig. 1. "Dearbornaire" air gage

Circle Item 138 on postcard, page 229

Electronic Control Unit

Industrial Electronics, Inc., Detroit, Mich., has announced a highly sensitive electronic control unit called the "Myke-A-Trol." This compact, packaged unit contains a rugged, yet highly sensitive mechanism. It is designed to remove the element of human error from many manufacturing operations, by controlling quality during the actual processing work. The control is intended for use with sensing elements built into gage heads for automatic measuring applications, gaging and sorting, weighing, pressure control, fatigue testing, and thickness control. It can be used for continuous or momentary gaging.



"Myke-A-Trol" unit introduced by Industrial Electronics, Inc.

This system of measurement has an over-all accuracy of 2 per cent, using standard transducers. Linear full scale displacement ranges of plus or minus 0.1 inch to plus or minus 100 micro-inches are incorporated in 20 scale divisions. Larger displacement ranges are available on special order. Any factor, such as pressure, weight, etc., can be measured in terms of dimensional change, and controlled accordingly. A calibrating push-button is located on the panel, to give an instant check on the over-all operation, at any time.

Circle Item 139 on postcard, page 229

Positioning Table for Production Drilling

A positioning table for production drilling operations has been developed by Howe & Fant, Inc., East Norwalk, Conn. This table is designed to facilitate duplication of any

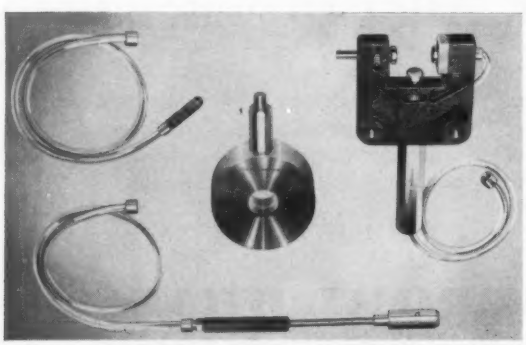


Fig. 2. Air gaging elements designed for use with instrument shown in Fig. 1

Howe & Fant positioning table for production drilling of holes to lay-out patterns

YOU'LL FIND G.S. GEARING IN TOP QUALITY PRODUCTS LIKE THESE . . .

Adding Machines • Aircraft Carburetors & Fuel Metering Systems • Aircraft Instruments and Radios • Automatic Musical Instruments • Business Machines • Check Signing & Protecting Machines • Clippers for Barbers, Animal Shearing & Hedge Trimming • Cloth Cutting Machines • Coin Changers & Counters • Communication Equipment • Electric Fans • Electric Motors • Floor Polishers, Sanders, Scrubbers, Sweepers • Food & Drink Mixers, Blenders • Home Appliances • Lawn Sprinklers • Machine Tools • Meat Tenderizers, Grinders, Slicers • Military Equipment • Motion Picture Cameras & Projectors • Outboard Motors • Pneumatic Production Tools • Radio & Radar Tuning Assemblies • Radio Anti-backlash Gears • Record Changers • Sewing Machines • Steel Strap Stretchers • Step Switches • Tapping, Drilling & Threading Equipment • Telephone Dials • Television Sets • Thermostatic Controls • Typewriters • Vending Machines • Washing Machines.

GEAR
Specialties, Inc.
2635 WEST MEDILL AVENUE
CHICAGO 47, ILLINOIS

SPURS • SPIRALS • HELICALS • BEVELS • INTERNALS
WORM GEARING • RACKS • THREAD GRINDING

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARING

ELECTRIC TOOLS GIVE EXTRA YEARS OF PERFECT SERVICE WITH G. S. SMALL GEARING

More and more makers of fine electric tools are turning to G. S. for Small Gearing. They quickly discover improved performance, in both product and production. Mechanisms run smoother, quieter, longer, *more dependably*. Assembly lines roll consistently, without painful headaches and interruptions. G. S. Small Gearing has been brought to its present perfection through more than 40 years of specialization. Men, machines, and exclusive methods are developed to a degree of UNIFORM accuracy beyond anything you ever thought possible. Write or call us now for *your* Small Gearing needs. We mass produce hundreds or thousands . . from 8 dp to 96 dp . . quickly, efficiently, at modest cost.

SEND FOR FREE *6-page Small Gearing Guide. It describes 80 types and applications. Contains useful charts . . a valuable aid to anyone interested in Small Gearing. Use company letterhead, please. No obligation, of course. Write today!*

FRACTIONAL HORSEPOWER GEARING

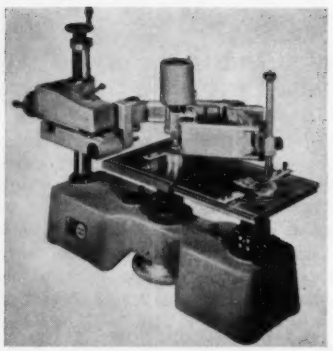
40 Years of Specializing in Small Gearing!

hole lay-out pattern within its capacity. It is fast-acting, accurate within 0.001 inch, and easily changed from job to job. The table is available in various sizes to meet a wide range of work requirements and can be mounted on any drilling machine.

The table consists essentially of a movable portion which rides freely over a predetermined area on ball thrust bearings; a removable hole-location plate which carries the particular hole pattern to be reproduced; an air-actuated locking mechanism which aligns the table with the machine spindle for each operation; and a fixed base which is fastened securely to the machine table.

To move from one hole center to another, the operator simply depresses a lever and slides the movable portion of the table to the approximate hole center for the next operation. At this point, the locking mechanism automatically pulls the table into correct alignment and holds it there until the cutting operation is completed.

Circle Item 140 on postcard, page 229



Scripta engraving and copying machine introduced by W. F. Machinery & Co.

Extension Bars for Hydraulically Actuated Table of DoALL Band-Sawing Machine

Table extension bars that provide outboard support for stock larger than the table and serve as adjustable back-stops for sawing both straight and irregular pieces on "Contour-matic" metal-cutting band saws have been brought out by the DoALL Co., Des Plaines, Ill. With these bars, set-ups for straight or angle cuts in metal plate or flat stock can be made in a few minutes. The bars are T-shaped and designed to fit the T-slots in the hydraulically actuated table.

The bars can be slid in or out of the table slots independently and quickly locked in any position with an Allen wrench applied as shown in Fig. 1. In this manner, the bars can be adjusted to provide outboard support for stock longer than the capacity of the table, as shown in Fig. 2. Studs on the ends of the bars serve as stops. The bars can be adjusted so that the studs bear against the edges of rectangular or irregularly shaped pieces which have been placed on the machine table for cutting. A twist of the table feed control causes the stock to be carried to the saw band for cutting at the desired angle. Once the extension bars are set, any number of similar pieces can be cut rapidly.

Scripta Three-Dimensional Engraving Machine

W. F. Machinery & Co., of Los Angeles, Calif., are introducing in this country a Scripta three-dimensional copying and engraving machine. This pantographic machine tool is designed to do engraving work in relief or intaglio, as well as to reproduce die-casting molds and embossing punches. Its principal feature is the pantograph of parallelogram form. One of the pantograph arms is extended to carry the stylus which traces the master and imparts corresponding movements, at reduced scale, to the revolving engraving cutter. The amount of reduction is controlled by two adjusting screws. The arms are of aluminum alloy and swivel on ball-bearing joints.

Any type of cutter from 0.118 to 0.315 inch in diameter can be used in the cutter spindle, which is driven through a resilient coupling by a vertically mounted motor. The motor spindle speed can be varied between 1000 and 12,000 R.P.M. through a built-in regulator. The cutter spindle is said to be designed so that cutter run-out can be held at less than 0.0008 inch.

The work-table is adjustable ver-

Circle Item 141 on postcard, page 229

(*Continued on page* 234)

Fig. 1. Adjusting work-supporting extension bars on DoALL band-sawing machine

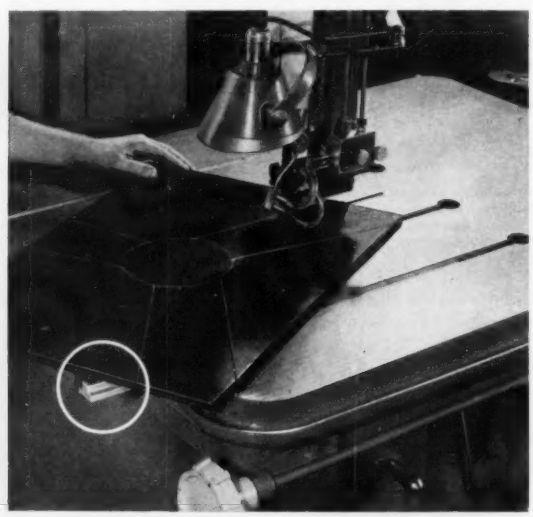


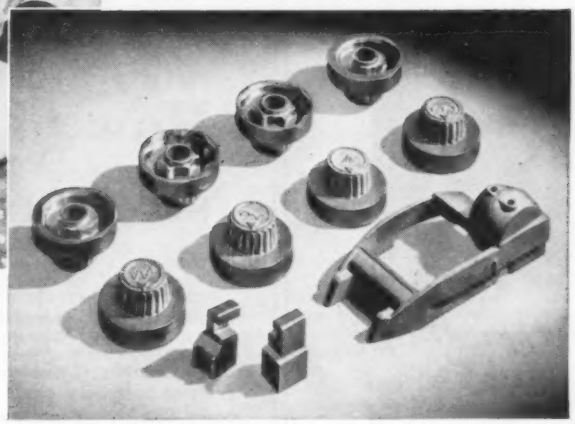
Fig. 2. DoALL band saw with hydraulically actuated table equipped with extension bars

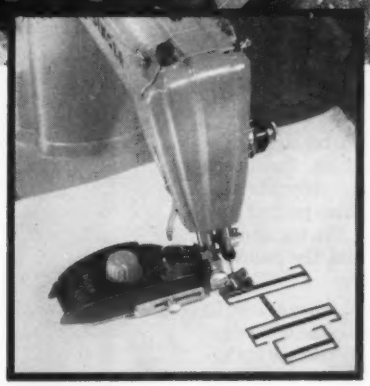
NUMBER 2 OF A SERIES

PRODUCTION SHORT CUTS WITH

ZINC

DIE CASTINGS . . . . .





SEWING UP A PRODUCT DESIGN AT SINGER

Part of the story behind the development of the Singer Automatic Zigzagger (an attachment for use with Singer sewing machines) reveals how—through the use of ZINC Die Castings—efficiency and economy can go hand-in-hand. The castings in the new assembly are shown at the right.

The first consideration in developing the Zigzagger was to establish a basic design which would permit milady to simply and efficiently create a variety of decorative effects merely through the interchange of different stitch patterns. The ultimate design called for some unusually shaped components which led Singer engineers to the specification of ZINC Die Castings. These parts are the cover frame, two presser bar seats and the eight interchangeable stitch patterns.

The economy of die casting the Zigzagger components stems from high speed multiple-cavity production, achieving dimensionally accurate, ready-to-assemble parts. The eight stitch patterns are cast with the sewing design engraved on each pattern head and, as can be seen in the underviews, unusually shaped cam tracks also are obtained on these castings. The smooth surfaces of the ZINC Die Cast cover frame require little preparation for a handsome paint coating.

For possible answers to *your* production problems, send for our brochure and contact any commercial die casting company.

◀ **Send for your copy.**

The New Jersey Zinc Company, 160 Front Street, New York 38, N. Y.

ZINC
FOR DIE CASTING ALLOYS

The Research was done, the Alloys were developed, and most Die Castings are based on

HORSE HEAD SPECIAL (99.99 + % Uniform Quality) ZINC

R B & W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

What's the right torque for bolts?

This is one of the toughest questions we're asked. Too many variable conditions. But the following may help.

The bolt takes two stresses during wrenching: (1) Torsion, (2) Tension. Tension is what you want. Torsion is the necessary evil due to friction. Probably 90% of applied torque goes to overcome friction.

With the friction factor changed by lubrication, plating, etc., the torque needed to produce a given tension is hard to predict. However, a useful empirical formula exists for *normal* friction conditions.

Inch-lbs. Torque = 0.2 x bolt diameter x bolt tension

Many tests show that the 0.2 torque coefficient is approximately constant for the usual friction conditions, for all diameters, and for both coarse and fine thread. Average deviation is about 7%. But when are conditions *"normal"?* The only *sure* way to check torque is to set up a pilot assembly and try it out.

In pilot testing for rigid joints, tighten a few bolts with torque wrench to failure, and then set torque at 75% of that load; or even at yield strength, since torsion component vanishes leaving bolt under tension only, which is well below ultimate strength.

We've worked up curves giving suggested torques for various size bolts. Send for a copy.

How to make a stronger joint

From research on structural steel joined with high strength bolts come facts applicable to *products:*

These bolts can be torqued to high tension for a large clamping force on joined members. Resultant friction overcomes shearing forces and prevents slippage. The higher compressive forces also protect bolt holes from fatigue cracks. Moreover, the tighter the bolt, the less chance for loosening, and the less risk of bolt fatigue due to dynamic loading.

High strength bolts are stronger in shear, too. In recent tests, rivets and "soft" bolts broke under extreme shear load; but high strength bolts didn't — the joined steel failed first.

APPLYING THE ADVANTAGES

Since high strength bolts have 2 to 3 times more tightening strength than common bolts, smaller diameter bolts can be used. As discussed above, these make a stronger joint; also weigh and cost less.

Along with good joint design, it's important that fasteners used can meet requirements. For example: A manufacturer designed vibrating machinery for high tensile bolts, but it was assembled with low carbon bolts. Joints failed. RB&W high carbon bolts with hardened washers solved the problem.

Moral: *Specify* even your standard fasteners.

RB&W selects the proper grade of steel to give "Empire" high strength fasteners the precise balance between *tensile strength* and *ductility.*

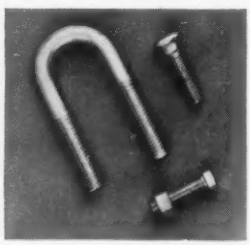
Feel free to call on RB&W for help in selection and use of standard, low cost fasteners.

Three radial dashes on bolt head denote a high strength bolt. The "E" identifies Empire bolts, an RB&W trademark. These markings assure highest quality standard fasteners with full strength, and uniformity of size and physicals.

●

Russell, Burdsall & Ward Bolt and Nut Company . . . plants at: Port Chester, N.Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

Silicon bronze fasteners combine desirable features



Silicon bronze offers the highest conductivity of fasteners able to withstand high stresses. It resists corrosion, stays free from season cracking, too. It makes ideal fasteners for electrical use where tensile strength is important; or for corrosive environments.

One of the first to develop such fasteners, RB&W cold works them for tensile strength and for clean, well formed threads that don't seize. Oval bolts, hex bolts and nuts and U bolts available. Specials can be developed.

For more information fill in page number on Inquiry Card, on page 229

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

WELDED CHAIN ASSEMBLIES—Bolt & Chain Division of Republic Steel Corporation, 3100 E. 45th St., Cleveland 27, Ohio. 62-page catalogue describing and illustrating different types of welded chain and chain assemblies, plus a complete line of accessories. Types of welded chain listed include Proof Coil, BBB, Republic Alloy, High Test, and a variety of other standard and special chain types. The first pages of the book form a general information section on welded chain, with important points on its care and maintenance. Detailed suggestions for correctly measuring and ordering chain are also included in this section. Various tables in the back of the catalogue help to make a complete chain reference book. The catalogue is available by writing direct to the Advertising Division of the above company.

V-BELT DRIVES—Allis-Chalmers Mfg. Co., 1009 W. 70th St., Milwaukee, Wis. 44-page booklet 20P50, giving multicolor tables for quick and easy selection of variable-speed "Texrope" drives. In addition to providing selection tables for the drives, the booklet includes information on design features, drive principles, horsepower rating tables, and a speed range table showing the variation in revolutions per minute when using two "Vari-Pitch" sheaves in combination, and accessory equipment for the drives. Copies are available on request from the above company.

INJECTION MOLDING—Eastman Chemical Products, Inc., Kingsport, Tenn. 51-page booklet describing injection molding of Tenite acetate and Tenite butyrate. The booklet deals with the methods of forming the Tenite materials into finished articles through injection molding and discusses the principles of injection-mold design. It also includes a suggested guide for correcting molding difficulties. Molders, designers, and other technical personnel may obtain a copy by writing to the above company.

CARBIDE INSERTS—Sandvik Steel, Inc., 1702 Nevins Road, Fair Lawn, N. J. 32-page catalogue No. 56, covering the complete line of COROMANT carbide tool products. Using dimensional drawings and specifications, the catalogue describes blanks, inserts, carbide-tipped tools, and combination cutters. Catalogue is available by writing on company letterhead to the above address.

METAL-WORKING MACHINES—O'Neil-Irwin Mfg. Co., Lake City, Minn. 44-page catalogue describing how Di-Acro metal-working machines perform a wide variety of forming, cutting, punching, and notching operations in medium and lightweight materials. A feature of the catalogue is the arrangement of machine specifications and material forming capacities which are in tabular form for quick, ready reference. List is given of complete specifications and cost information on standard press brake dies as well as press brake engineering tables. 1

LATHES—Axelson Mfg. Co., Division of U. S. Industries, Inc., Los Angeles, Calif. 2-page bulletin describing 32- by 100-inch and 32- by 125-inch slide bed gap lathes. The lathes, which can be pit or platform mounted, are designed for turning parts such as knee joints, shafts with large discs, and similar odd-shaped parts with extreme projections from the lathe center line. Complete dimensions, specifications, and a list of attachments are presented in the bulletin, along with application photographs of the machines turning landing gear struts and large matched metal molds. 2

GEAR SHAVING MACHINES—National Broach & Machine Co., Detroit, Mich. Illustrated catalogue S-56-1, describing Red Ring Model GC1 rotary gear shaving machines for shaving external or internal spur and helical gears. Design features, operating principles, and an automatic differential up and down feed mechanism are described and illustrated. Specification tables are given for a complete line of shaving machines, including three standard machines for external gears from 1 inch to 18 inches in pitch diameter 3

ELECTRIC RESISTANCE WELDING—Sciaky Bros., Inc., Chicago, Ill. Bulletin 331, describing and illustrating how resistance welding improves product design. Other topics discussed are production rates, labor demands, corrosion and weight factors, and strength and appearance. Sections dealing with spot, seam, projection, and flash-butt welding are divided into three basic groups. With each resistance welding type, definition, particular advantages, and what to consider when designing with this method are outlined. 4

HARDNESS TESTERS—Wilson Mechanical Instrument Division, American Chain & Cable Co., Inc., Bridgeport, Conn. Bulletin DH-328, describing the company's Tukon testers for micro and macro hardness testing. These testers make possible microhardness testing, using extremely shallow indentations. They may be used for testing metallic or non-metallic parts, such as fine wire small precision parts, thin metal, superficially hardened surfaces, and others. 5

PRESS CONTROLS—Danly Machine Specialties, Inc., Chicago, Ill. 12-page catalogue describing and illustrating controls specifically designed to provide better operation of presses and press accessories, automatic feed devices, scrap cutters, and others. The booklet explains that such controls can provide better efficiency,

FIRST CLASS
Permit No. 53
(Sec. 34.9, P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY—

MACHINERY
93 WORTH STREET
NEW YORK 13, N. Y.

READERS' SERVICE DEPT.

flexibility, and safety to presses, dies, and operators than ordinary all-purpose electrical or mechanical controls. 6

THREADING MACHINE—Landis Machine Co., Waynesboro, Pa. Bulletin No. E-88-1, describing the company's 4-spindle semi-automatic threading machine. Detailed data concerning construction, operation, design features, and specifications is contained. It is a precision machine designed for the threading of automotive parts, bolts, studs, rods, and similar work-pieces. It can also be adapted for hollow-milling applications. 7

METAL-FINISHING STANDARDS—Allen Mfg. Co., Hartford, Conn. 12-page booklet covering plating and surface treatment. First section is devoted to general facts on metal finishing. Second section covers various types of plating with a clear statement of advantages and limitations, applications, specifications, and appearance of each type. Third section is a similar table for various types of surface treatment. 8

COOLING COILS—Halstead & Mitchell, Pittsburgh, Pa. Catalogue DE-200, describing in detail the company's line of direct expansion cooling coils using "Turbo-Flo" finned surface for extra high heat transfer. The catalogue describes the construction of the coils, including tubing, casings, headers, refrigerant distribution, return bends, and valves. Test and dehydration, as well as means of specifying special coils, are also described. 9

TURBINES—General Electric Co., Schenectady, N. Y. Folder GEA-6232, giving instructions and design features of turbine drives for centrifugal compressors and blowers. Cross-sections, schematic drawings, cut-aways, and typical installation photos point out design features and applications for single-valve, single and multi-stage turbines, as well as multi-valve multi-stage and multi-valve single-stage units for high back pressure applications. 10

SHAFT SEALS—Crane Packing Co., Morton Grove, Ill. 8-page bulletin S-205-2, describing the company's complete line of chemically inert mechanical seals for handling all types acids, corrosives, solvents, and gases. The bulletin provides construction, service, and application information including representative installations and engineering details. 11

TRACER MILLING UNIT—Sundstrand Machine Tool Co., Rockford, Ill. Circular 3D-1, describing the three-dimension tracer milling unit that was designed for taking numerous cuts on large work-pieces by moving the cutter instead of the work-piece. The unit is self-contained and can easily be moved to many different positions to make intricate cuts in transverse, longitudinal, or vertical directions. 12

INDUSTRIAL STRONGBOX SOLENOIDS—General Electric Co., Schenectady, N. Y. Bulletin GEA-6215A, giving applications and accessory information on the company's industrial strongbox solenoids. The two-color publication includes descriptive material on terminal covers and linkage pins, detailed outline dimensions on alternating-current strongbox solenoids, and new price reduction figures. 13

MOTOR PUMPS—Chempump Corporation, Philadelphia, Pa. 4-page bulletin giving features and specifications of the company's line of canned motor pumps for general process pumping. Included are performance curves, dimensions, principles of construction and operation, cut-away views, materials available, power requirements, and other descriptive material. 14

SOCKET SET SCREW FEEDER AND DRIVER—Socket Set Screw Division of the Bristol Co., Waterbury, Conn. Bulletin 738, describing the company's automatic socket set screw feeder and driver. Major features of this feeder are that it handles standard socket set screws and performs a 100 per cent feed operation, by automatically positioning the screws "right end up." 15

DRILLS AND REAMERS—Chicago-Latrobe, Chicago, Ill. Folder describing the company's complete line of Harduty drills and reamers. Harduty drills are carbide-tipped and are designed for accurate drilling in hardened die steel, 45 to 65 Rockwell C. Harduty reamers are also carbide-tipped and are recommended for use in hardened steel having a Rockwell 45 C scale or harder. 16

RELAYS—American Machine & Foundry Co., New York City. 12-page folder covering the various factors to be considered in selecting an electrical relay for a given application. These factors include circuit characteristics, type of switching, actuation power, operating speed, duty cycle, life expectancy, and cost. 17

RIGHT-ANGLE GEAR-MOTOR—Westinghouse Electric Corporation, Gearing Division, Nuttall, Pa. Booklet B-6579, giving information on the type R right-angle gear-motor for applications requiring 1-30 horsepower. A chart is also provided showing the relationship between output torque capacity and total gear ratio. 18

STRESS VALUES—Tubular Products Division of Babcock & Wilcox Co., Beaver Falls, Pa. Technical data card 154A, giving maximum allowable stress values (S) for ferrous pipe and tubing. Included are the values at various temperatures for a complete range of seamless and welded carbon, alloy, and stainless tubing steels. 19

EXPANDING COLLET—Erickson Tool Co., Cleveland, Ohio. 4-page bulletin describing the company's expanding collet. Illustrated with halftone cut and dimensional diagrams, the bulletin gives detailed information on the design principle, outstanding features, applications, and special designs to suit specific needs. 20

RESISTANCE WELDERS — Precision Welder & Flexopress Corporation, Cincinnati, Ohio. 6-page bulletin G-100, covering the company's resistance welders. In addition to the standard and semi-standard line of welders, the bulletin describes precision specials designed and tooled to solve specific and unusual production problems. 21

DRILL ROD—Anchor Drawn Steel Co., Latrobe, Pa. Folder describing the company's colonial No. 6 non-shrinkable oil-hardening drill rod made of high carbon, manganese steel with tungsten, chromium, and vanadium added to give extra strength. Detailed specification chart is included. 22

Product Information Service

Use postage-free Business Reply Card below for further information on New Catalogues or New Shop Equipment described in this issue and products mentioned in the advertisements.

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

CATALOGUES

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54	55	56
57	58	59	60	61	62								

NEW SHOP EQUIPMENT

101	102	103	104	105	106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142
143	144	145	146	147	148	149	150	151	152	153	154	155	156

ADVERTISED PRODUCTS

Page ..... Advertiser .....

Page ..... Advertiser .....

Page ..... Advertiser .....

Page ..... Advertiser .....

Page ..... Advertiser .....

Please print your name and address

NAME .....

TITLE .....

COMPANY .....

CO. ADDRESS .....

CITY ..... ZONE ..... STATE .....

This card is void after September 1, 1956 M-6/56

STEEL PIPE AND TUBING—Tubular Products Division, Babcock & Wilcox Co., Beaver Falls, Pa. 6-page folder TDC-163A, furnishing information on analysis, mechanical and physical properties, and creep and rupture data on many of the various tubing alloys that proved satisfactory in elevated temperature service. 23

ALLOY STEEL PLATE—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Leaflet describing the company's E8615 case-hardening steel plate stocked in 72- by 240-inch size in thicknesses from 1/2 inch to 6 inches inclusive. Flats, rings, discs, and irregular shapes flame-cut from E8615 steel plate are available. 24

SNAP HEARTH FURNACE — Surface Combustion Corporation, Toledo, Ohio. Folder SC-173, describing the company's snap hearth furnace with radiant tube heating, eliminating the muffle with its maintenance and replacement problems. Suction type radiant tubes serve to prevent contamination of prepared atmosphere. 25

AUTOMATIC TRANSFER SWITCHES—Automatic Switch Co., Orange, N. J. 16-page brochure No. 596, entitled "Factors to Consider in the Selection of Automatic Transfer Switches." Features required for adequate design are concisely listed, and information is given on why these features are essential. 26

FLAT LAPPING—J. B. Maris Co., Bloomfield, N. J. Illustrated brochure describing in detail the advantages and features of the company's production flat lapping service where flatness, surface finish, and parallelism are desired in finishing of all metals, plastics, ceramics, glass, and other materials. 27

PRODUCTION PRACTICE—Wales Strippit Corporation, North Tonawanda, N. Y. 18-page catalogue giving an over-all description of the company's equipment responsible for economies in tooling and fabrication. Complete working information of Wales units is given in detailed catalogues. 28

SUBLAND TOOLS—Mohawk Tools, Inc., Montpelier, Ohio. 28-page catalogue describing all types, uses, and advantages of subland tools. Information is given on where sublands can be used to increase production rates and, at the same time, reduce operating and tooling costs. 29

TRANSMISSIONS—American Gear & Mfg. Co., Lemont, Ill. 8-page booklet describing seven different models of the company's new Plan-Gear transmissions which are offered with one or two forward speeds, a choice of reverse gear ratios, and 85- to 150-pound-foot to 200-pound-foot torque. 30

FLAME HARDENING—National Forge & Ordnance Co., Warren County, Pa. Descriptive folder giving details on the company's large forging machine for the surface hardening of shafts, rolls, piston rods, forging hammer rods, and others by the oxy-acetylene flame process. ... 31

ELECTRIC TOOLS—Thor Power Tool Co., Aurora, Ill. 44-page catalogue 39-C, describing the company's complete line of Silver Line and Speed Tool electric tools for use in the automotive, industrial, construction, maintenance, trade crafts, and home workshop fields. 32

TOOL STEEL GUIDE—Vanadium-Alloys Steel Co., Latrobe, Pa. 68-page, ring-bound booklet clearly indexing and describing the entire line of the company's steels. Ordering instructions and a list of representatives throughout this country and Europe are given. 33

WIRE DRAWING MACHINES—Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. 8-page catalogue No. 786-W-3, describing the company's Tandem continuous wire drawing machines for high-speed heavy continuous drawing of non-ferrous materials 34

INVESTMENT CASTING—Haynes Stellite Co., a Division of Union Carbide and Carbon Corporation, New York City. 40-page booklet giving information on physical, mechanical, and chemical properties of twenty-six investment-casting alloys. 35

ASSEMBLY MACHINE—Multra Corporation, a subsidiary of Barnes Engineering Co., Stamford, Conn. 12-page two-color brochure describing all features of the 7000-pound Multra automatic assembly machine, and giving details for complete part-by-part assembly of a product. 36

LIQUID SPRINGS—Taylor Devices, Inc., North Tonawanda, N. Y. Catalogue LS, describing and illustrating the complete line of the company's liquid springs, designed especially for replacing coil springs in die applications using liquid compressibility. 37

FEEDING EQUIPMENT—F. J. Littell Machine Co., Chicago, Ill. 28-page pocket-size folder entitled "Pre-View," giving information on the company's feeding equipment for punch presses and reels and straightening machines for coil stock. 38

CUTTING SAWS—Ty-Sa-Man Machine Co., Knoxville, Tenn. 8-page brochure No. 1235, covering friction, abrasive, and cut-off saws. Information is given on all the models and latest adaptations of the company's line of cutting tools. 39

PRESSURE TEST MACHINES—Modern Industrial Engineering Co., Detroit, Mich. Bulletin PT-1, describing the company's

FIRST CLASS
Permit No. 53
(Sec. 34.9, P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY—

MACHINERY
93 WORTH STREET
NEW YORK 13, N. Y.

READERS' SERVICE DEPT.

FIRST CLASS
Permit No. 53
(Sec. 34.9, P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY—

MACHINERY
93 WORTH STREET
NEW YORK 13, N. Y.

READERS' SERVICE DEPT.

standard and special-purpose test machines for automotive, appliance, aircraft, and farm equipment industries. **40**

ULTRASONIC INSPECTION — Sperry Products, Inc., Danbury, Conn. Bulletin 50-105, describing the company's Reflectoscope used for ultrasonic inspection—a non-destructive method for detection and location of defects in materials. **41**

PUMPS—C. H. Wheeler Mfg. Co., Philadelphia, Pa. Catalogue No. A-156, describing the company's double suction single-stage centrifugal pumps recommended for general service wherever liquids of low viscosity are to be moved. **42**

ADHESIVE BONDING—Rubber & Asbestos Corporation, Bloomfield, N. J. 8-page illustrated booklet describing application techniques and precautions, advantages, and limitations of adhesive bonding at room temperature. **43**

VIBRATORY FEEDERS—Perry Equipment & Engineering Co., Erie, Pa. Catalogue 356, describing the company's line of Peeco vibratory parts feeders, engineered cast bowls, overhead hoppers, and orientation tracks. **44**

LUBRICATION SYSTEMS—Bijur Lubricating Corporation, Rochelle Park, N. J. 2-page service instruction sheet describing the company's cyclic type automatic lubricators which are driven by the machine they lubricate. **45**

DIE FILER—Sales Service Machine Tool Co., St. Paul, Minn. Bulletin illustrating and describing the company's die filer which is available in three models. This unit performs filing, sawing, and lapping operations. **46**

DRYERS—Murphy & Miller, Inc., Chicago, Ill. Catalogue illustrating and describing the company's dryers for compressed air and gases. Features and operating details of the automatically operating dryers are included. **47**

MILLING CUTTER—Wesson Co., Ferndale, Mich. 6-page bulletin entitled "A New Dimension in Milling Cutter Design," covering development of milling cutters which eliminate sharpening. **48**

SILICONES—Silicones Division, Union Carbide and Carbon Corporation, New York City. 8-page illustrated booklet describing the company's silicones for the shell-molding process. **49**

RESINS—Chemical Division, Koppers Co., Inc., Pittsburgh, Pa. Technical Bulletin entitled "Penacolite Brittle Resins B-1A, B-16, B-22," describing the properties of these adhesives. **50**

HYDRAULIC STRAIGHT THREAD FITTINGS—L & L Manufacturing Co., Van Dyke, Mich. Brochure ST-56, describing and illustrating three sealing applications on straight thread fittings. **51**

BEARINGS—Johnson Bronze Co., New Castle, Pa. Pocket-size catalogue covering the company's entire line of industrial bearings, bushings, and bars. ..**52**

PUMPS—Ingersoll-Rand Co., New York City. Bulletin Form 7248-A, covering the company's redesigned line of DMV-DHV single-stage centrifugal pumps. **53**

FOLDERS AND BRAKES—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 74-C, describing the company's line of folders and brakes. **54**

ELECTRONIC DUPLICATOR—Voss Engineering Co., Pittsburgh, Pa. Catalogue describing the company's Voss-Raytheon single-motion electronic duplicator. ..**55**

WHEEL FORMING ATTACHMENT—Pratt & Whitney Co., Inc., West Hartford, Conn. Circular 596, describing the company's Diaform wheel forming attachment. **56**

DUAL AIR VALVE—Danly Machine Specialties, Inc., Chicago, Ill. Bulletin No. 1902B, describing the company's 1 1/4 inch dual air valve. **57**

GRINDING WHEELS—DoALL Co., Des Plaines, Ill. Catalogue covering the company's complete line of surface grinding and bench grinding wheels. The catalogue contains data explaining the meaning of grinding wheel code numbers or "markings." Composition and applications of fundamental types of wheels are described. **58**

NICKEL-CLAD COPPER WIRE—Alloy Metal Wire Division, H. K. Porter Co., Inc., Prospect Park, Pa. Technical bulletin T-3, presenting engineering and application information on nickel-clad copper wire. Also included is data on the electrical characteristics of the material. **59**

PRECISION DYNAMOMETER—George Scherr Co., Inc., New York City. 4-page illustrated folder describing the company's precision dynamometer for determining the force required to actuate delicate mechanisms. **60**

PLUG GAGES—Pratt & Whitney Co., Inc., West Hartford, Conn. Folder describing the company's precision lapped reversible plug gages made to American gage design standards. **61**

PLATEN PRESS—Rodgers Hydraulic, Inc., Minneapolis, Minn. 4-page brochure describing platen press applications for metal drawing, metal forming, and plastic and ceramic molding. **62**

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

CATALOGUES

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54	55	56
57	58	59	60	61	62								

NEW SHOP EQUIPMENT

101	102	103	104	105	106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142
143	144	145	146	147	148	149	150	151	152	153	154	155	156

ADVERTISED PRODUCTS

Page ..... Advertiser .....
Page ..... Advertiser .....
Page ..... Advertiser .....
Page ..... Advertiser .....
Page ..... Advertiser .....

Please print your name and address

NAME .....
TITLE .....
COMPANY .....
CO. ADDRESS .....
CITY ..... ZONE ..... STATE .....

This card is void after September 1, 1956 M-6/56

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

CATALOGUES

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54	55	56
57	58	59	60	61	62								

NEW SHOP EQUIPMENT

101	102	103	104	105	106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142
143	144	145	146	147	148	149	150	151	152	153	154	155	156

ADVERTISED PRODUCTS

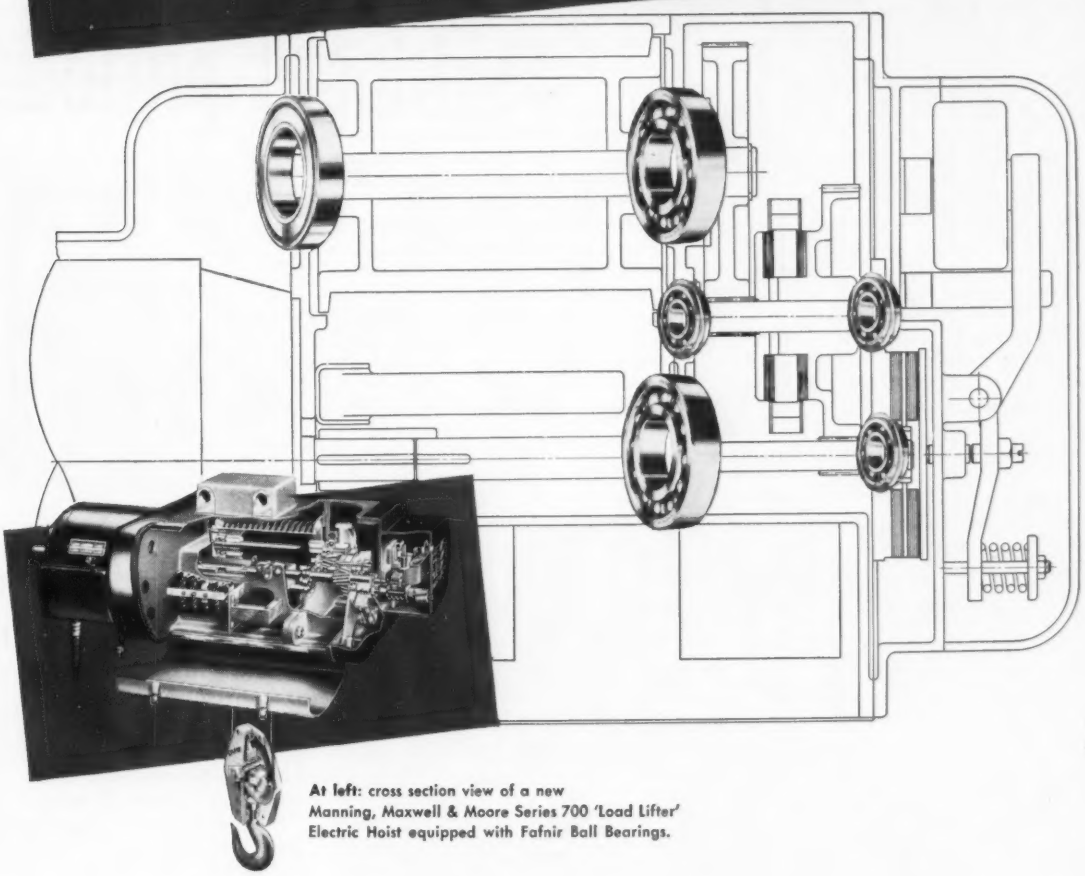
Page ..... Advertiser .....
Page ..... Advertiser .....
Page ..... Advertiser .....
Page ..... Advertiser .....
Page ..... Advertiser .....

Please print your name and address

NAME .....
TITLE .....
COMPANY .....
CO. ADDRESS .....
CITY ..... ZONE ..... STATE .....

This card is void after September 1, 1956 M-6/56

How an "Industrial Muscle" is kept from getting "Muscle-bound"



At left: cross section view of a new Manning, Maxwell & Moore Series 700 'Load Lifter' Electric Hoist equipped with Fafnir Ball Bearings.

Every bearing indicated in the diagram above highlights the strategy of Manning, Maxwell & Moore's electric hoist designers. Each eliminates a possible source of trouble caused by friction... on rope drum (bearing lubricated for life) on trolley assembly, on gear shafts, etc.

With critical turning points protected, this heavy-duty 1-ton capacity hoist is offered for three-shift lifting *every day in the year.* It lifts a ton, thirty feet a minute. Power is concentrated on lifting, not shared to overcome friction. It's smooth, steady, and efficient. Lubrication becomes a minor detail.

Fafnir is a supplier of Ball Bearings for Manning, Maxwell & Moore hoists and for hundreds of other industrial machines where Ball Bearing advantages improve performance and prolong service-life. The choice of Fafnir Ball Bearings, in case after case, has been influenced by the Fafnir "attitude and aptitude" . . . a way of looking at bearing problems from the designer's viewpoint, an aptitude for supplying the right ball bearing to fit the need. Maybe these attributes can help you solve a bearing problem. The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR **BALL BEARINGS**

MOST COMPLETE LINE IN AMERICA

For more information fill in page number on Inquiry Card, on page 229

tically by a screw and controlled by a large-diameter vernier scale. The copy-holding table is also adjustable vertically. There is a vertical movement for the pantograph assembly which is adjustable horizontally for precise positioning of the cutter.

Ratios of reduction on the pantograph are from 1 to 2 up to 1 to 6, thus enabling twenty-three different dimensions to be obtained from one guide, such as a letter or figure. The maximum height of work accommodated under the pantograph is 5.3 inches; with an extra-long vertical column, this is increased to 16.14 inches. The surface covered at one setting, with the pantograph set for a 1 to 2 ratio, is 15.75 by 9.8 inches.

Circle Item 142 on postcard, page 229

Transfer Machine for Processing Oil-Pump Bodies

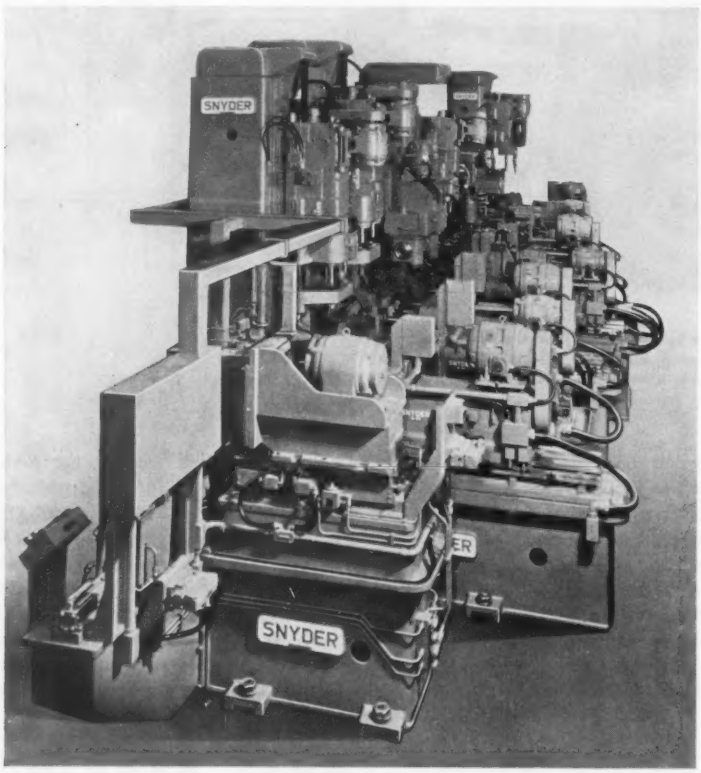
A 100-foot long, eighty-four-station segmented transfer machine that machines, washes, and air-tests cast-iron automotive oil-pump bodies at a rate of 103 pieces per hour at 75 per cent efficiency has been designed and built by Snyder Tool & Engineering Co., Detroit, Mich. A feature of this equipment is a distribution system that feeds the finished and tested parts to three conventional precision boring machines according to the demands of each machine.

A wide variety of drilling, milling, reaming, tapping, trepanning, boring, spot-facing, countersinking, and chamfering operations is performed in the first twelve segments and forty-three stations of the machine. The parts are rotated 90 degrees and turned 90 degrees in the sixth segment to permit the drilling, boring, and milling of other plane faces in the oil-pump body. Probing devices are provided at certain stations that shut down the machine if tap-drilled holes are incomplete.

Parts are washed in Segment 13, which has eight stations, and then are air-tested in Segment 14, which has two stations. Any parts that do not pass the test are automatically rejected from the transfer line. Then, the parts are fed through three segments having a total of thirty-one stations. Each segment has a parts-distributor mechanism for a precision boring machine. Two parts are stored ahead of each machine. A part is automatically directed to any of the machines where less than two parts are stored ahead of it. Thus a part may be passed by the first two boring machines and fed to the third, depending on the stacking condition of the first two machines.

Like other Snyder electrically operated, hydraulically controlled, segmented transfer machines, this machine has individual segments, each having bases and control panels to simplify construction, maintenance, and part design change problems.

Circle Item 143 on postcard, page 229



Snyder segmented transfer machine that machines, washes, and tests cast-iron oil-pump bodies and feeds them to each of three precision boring machines

Fig. 1. Model WP4 pallet truck with a 4000-pound load capacity

"Transporter" Line of Trucks and Tractors

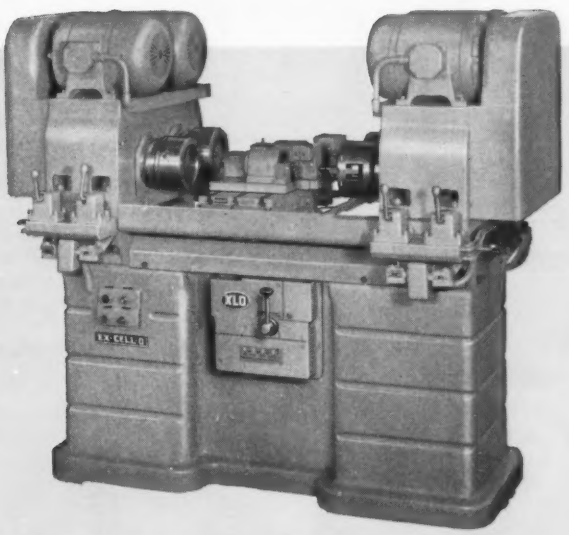
The Automatic Transportation Co., Division of Yale & Towne Mfg. Co., Chicago, Ill., is introducing a complete line of operator-led, electric-driven industrial trucks. This "Transporter" series will include pallet models, high- and low-drift platform trucks, high-lift suspended load type stackers, and tractors. Among the features incorporated in this improved line is the "Pallet-Chek," a set of spring-loaded pawls that holds the unloaded pallet firmly while the forks enter, thus saving time and eliminating, in most cases, the need for chamfering the end boards in double-faced pallets.

Simple three-point lubrication allows all load-bearing surfaces to be lubricated regularly in a matter of seconds. The ultra-compact design of the "Transporter" line serves to reduce aisle space requirements and facilitates maneuvering in tight quarters. The new trucks measure only 21 1/2 inches plus length of load

(*Continued on page* 236)

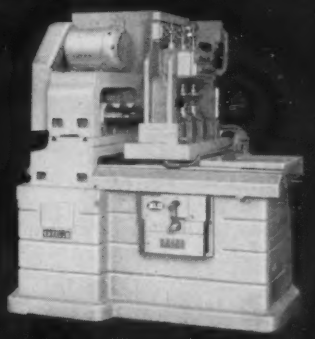
MAXIMUM PRODUCTION SPEEDS — LOWER COSTS WITH THESE MODERN

Ex-Cell-O Precision Boring Machines

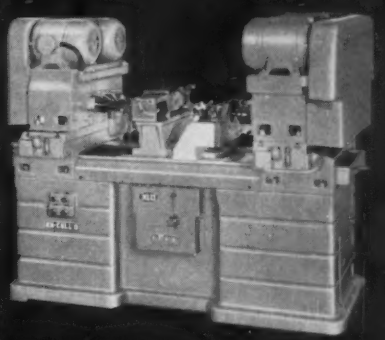


STYLE 1212-B. For identical or different operations at each end. When loading time of parts approximates the time of machining, a double-end machine practically doubles production.

STYLE 2112-B. Single-end model for work pieces in the small and medium-size range. Flexible hydraulic controls give easy adjustment of work cycle.



STYLE 112-D. Large and sturdy with long stroke. Accommodates medium and heavy work, gives maximum precision production, minimum operating cost.



STYLE 17-A. Massive construction. Maintains the highest precision standards on a profitable production basis. Economical in operation, can be tooled for a wide range of production jobs.

These versatile Ex-Cell-O Precision Boring Machines bore, turn, face, counterbore, chamfer and groove.

Whichever model fits your production requirements, you'll find this large variety of precision operations will lower your costs—increase your profits.

All Standard Ex-Cell-O Precision Boring Machines can be equipped for work handling and ejecting operations, thus providing fast, automatic production at minimum cost.

Contact your local Ex-Cell-O representative who will provide all the facts about these machines, or write to Ex-Cell-O for a precision boring catalog.

XLO
EX-CELL-O *for* PRECISION

56-16

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Fig. 2. Model WST 20 "Transporter" stacker with lift of 135 inches and 2000-pound capacity

and yet have a standard 8 1/4 inch battery compartment.

Other model trucks include the Dynamotive 40 with pneumatic tires. This rider type gas truck with electric transmission has been redesigned, permitting the use of pneumatic tires for rough going in out-of-doors use and smoother riding on indoor floors.

Circle Item 144 on postcard, page 229

Ettco-Emrick Tapping Attachment and Multiple-Spindle Drill Head

A planetary gear arrangement, which reduces tap speed to one-third the drill spindle speed, gives the No. 3-B tapping attachment brought out by Ettco Tool Co., Inc., Brooklyn, N. Y., the extra power needed to tap or thread large holes on small drill presses. The unit is oil-filled and sealed at the factory. In operation, a fan on the steel clutch whips the oil into a fine mist which provides efficient cooling and effective lubrication. The unit utilizes an Ettco-Emrick No. 3-E visible grip balanced tap chuck which can accommodate any standard tap or button die holder. The maximum tapping and threading capacity in steel is 1/2 inch. Available with either a No. 1 or No. 2 taper shank or female adapter, the 3-B tapper can be fitted to any drill press.

Another recently announced product is a Model 800 flexible-shaft-driven adjustable-spindle multiple head of extremely lightweight and compact design. This unit is built for both tapping and drilling up to eight holes on any tapping or drilling machine.

Accurate positioning of the spindles is accomplished by means of spindle adjusting arms which can be moved in and out or transversely even while the unit is operating. Jig-bored templates can be supplied in place of the adjusting arms where a fixed-center set-up is desired. Individual shafts, spindles, and adjusting arms are removable as integral units when fewer than eight spindles are

Tapping attachment brought out by the Ettco Tool Co., Inc.

used. A 1 to 1 drive ratio permits the unit to be used for lead-screw tapping. Capacities of the unit range up to 5/16 inch drills and taps in aluminum. Maximum bolt circle diameter capacity is 8.812 inches. Minimum center distance between spindles is 5/8 inch.

Circle Item 145 on postcard, page 229

Scully-Jones Tap Driver, Chuck, and Drift Tool Ejector

Scully-Jones & Co., Chicago, Ill., have developed an improved line of "Safe-Torque" tap drivers. These drivers, shown in Fig. 1, will accommodate a wide range of tap sizes and provide accurate torque adjustment to suit varied operating conditions. They prevent or reduce tap breakage through a modified overriding clutch, which completely disengages the tap from the driver before excessive overloading occurs. No noise or impact is said to accompany the release of these drivers.

Standard "Safe-Torque" tap drivers are designed for use on any machine with a reversible spindle (except transfer machines, drilling heads, and automatics with lead-screws which require special drivers with compensating springs). Trial adjustment of torque is extremely simple because every driver is marked with a normal and high-torque setting for each tap size. The torque setting for maximum tap life and accuracy depends on a variety of conditions.

The "Better-Hold" chuck, shown in Fig. 2, is one of a line developed for use with shank type cutting tools. These chucks can be made to apply a powerful, accurate centering grip on tools by twisting the threaded lock-and-eject nut. This action draws a split collet with an externally tapered surface into compression against a mating, internally tapered surface of the chuck.

The new cam type "Scully-Drift"

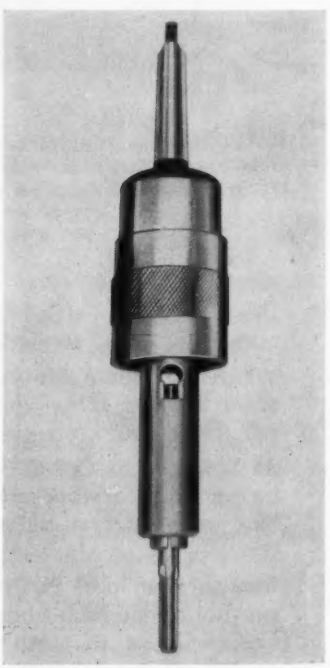


Fig. 1. Scully-Jones "Safe-Torque" tap driver

Your BEST PACKAGED BUY in milling spindles...

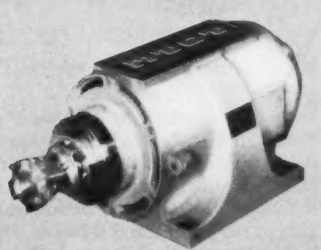
POPE

HEAVY DUTY PRECISION SPINDLES

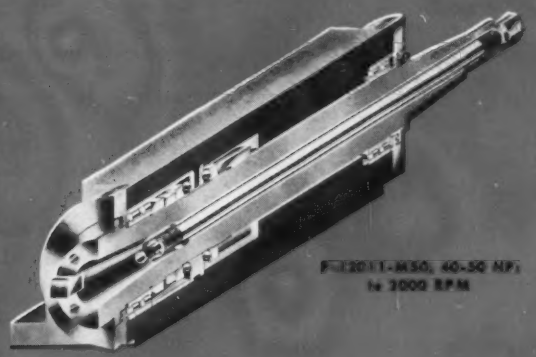
P-12000 Series *Belt Driven* in sizes from 1 to 50 HP, with Standard milling machine tapers in the nose from #10 to #60. *Operable in any position you specify.*

See: the big shaft, the heavy duty double row cylindrical roller bearings and thrust bearings that have extra ability and the rigidity to support your cutting tools.

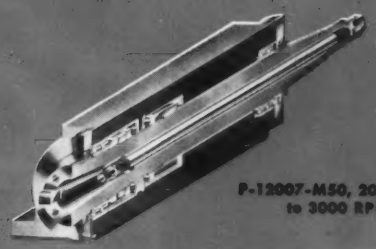
For complete dimensions, write for Bulletin S-8



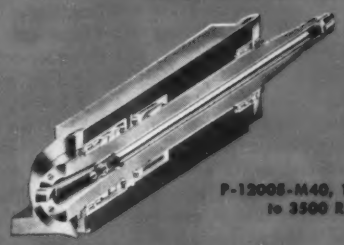
POPE HEAVY DUTY MOTORIZED MILLING MACHINE SPINDLES are available in P-2500 Series, from 1 to 100 HP, totally-enclosed, fan cooled; also in high cycle, water cooled units.



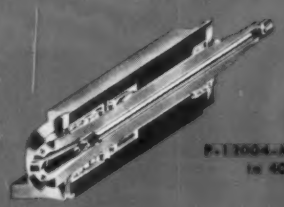
P-12011-M50, 40-50 HP; to 3000 RPM



P-12007-M50, 20-25 HP; to 3000 RPM



P-12005-M40, 10-15 HP; to 3500 RPM



P-12004-M40, 5-10 HP; to 4000 RPM

P-12003-M30, 2-5 HP; to 5000 RPM

You can specify POPE PRECISION SPINDLES with Confidence No. 110

Specify **POPE** PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET • HAVERHILL, MASSACHUSETTS

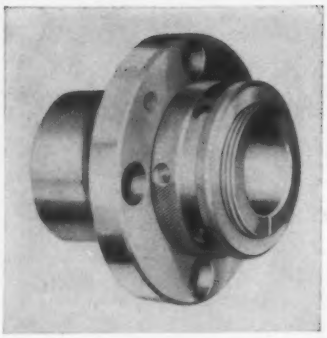


Fig. 2. "Better-Hold" chuck for shank type cutting tools

Fig. 3. "Scully-Drift" for ejecting tool from holder

tool ejector, Fig. 3, is said to virtually eliminate damage to machine spindles and bearings caused by hammering on conventional drifts or other devices. An important advantage of the "Scully-Drift" is that it can be used with one hand, allowing the operator to maintain complete control of the tool with the other hand. This tool ejector is designed with a cam-shaped profile on its bottom edge so that a mere twist of the wrist generates a powerful force against the tang of the tool, forcing it free from its locked position in the internal taper of the machine spindle. Made for Nos. 2 and 3 Morse taper.

Circle Item 146 on postcard, page 229

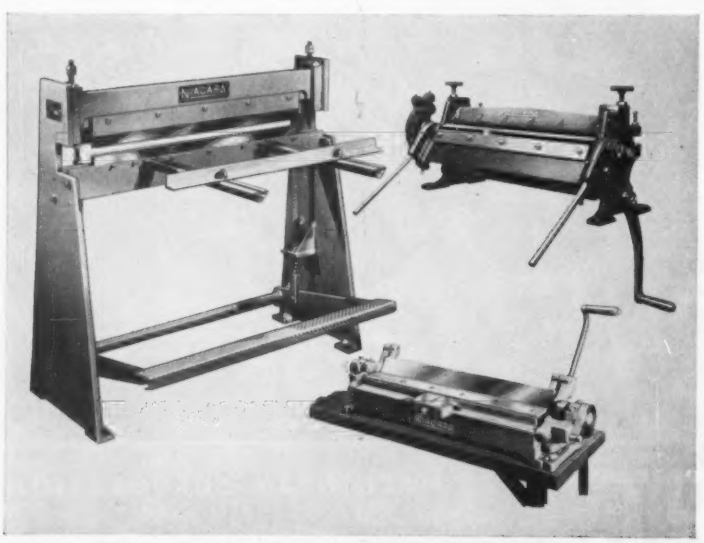
Niagara Sheet-Metal Folders and Brakes

Modernized lines of folders and brakes built by Niagara Machine & Tool Works, Buffalo, N.Y. are now available in several models to meet a wide range of sheet-metal folding requirements. The adjustable bar folders embody the following features: clamping and folding with one motion of handle; adjustable gage and jaw for accommodating different width folds and various thicknesses of material; and self-contained spiral spring counterbalance requiring no extra bench space. The machines are available in working lengths of 21 through 42 inches. There are four hand-operated and three air-actuated models.

A foot brake, with a 36-inch working length, produces bends any distance from the edge of the sheet. Its gage for locating the bend can be attached to either the front or rear of the machine. Adjustable stops, conveniently located on the slide, regulate the angle of bend. An air-actuated model is also available.

The universal folders and brakes are made in two models having working length capacities of 30 and 42 inches.

Circle Item 147 on postcard, page 229



(Left) Niagara Model 92 foot brake. (Upper Right) Model 81 universal folder and brake. (Lower right) Niagara Model 3 adjustable bar folder with spiral spring counterbalance

Lufkin Depth Gage and Deep-Throat Micrometer

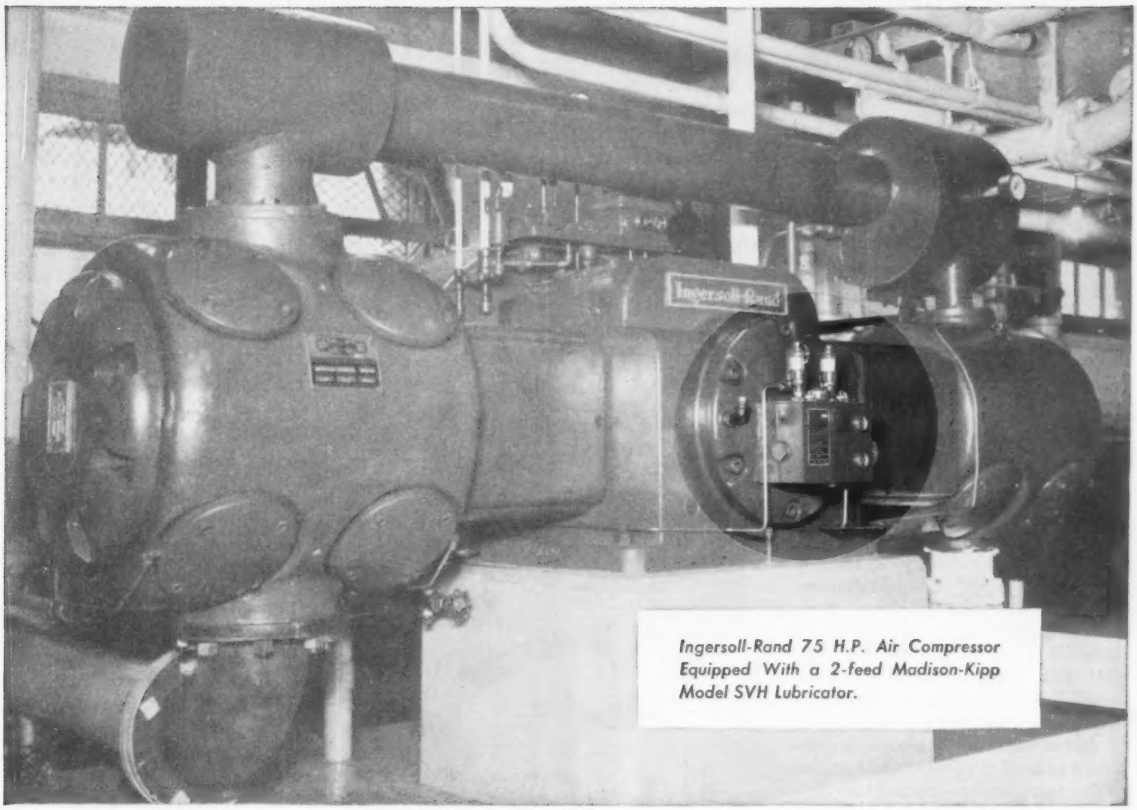
A micrometer depth gage with a graduated base is announced by the Lufkin Rule Co., Saginaw, Mich. To permit taking depth measurements of holes and slots at a specified distance from the edge of the work, the base is graduated on one side, as shown in Fig. 1. Graduations are in 0.020 inch and extend 2.4 inches on both sides of the zero line located in the exact center of the base. Available in ranges of 3 and 6 inches with lock-nut or with lock-nut and ratchet.

Fig. 1. Lufkin micrometer depth gage

Fig. 2. Lufkin deep-throat micrometer

A micrometer, Fig. 2, with a deep-throat frame, has also been announced by the Lufkin Rule Co. This instrument is designed for gaging the thickness of metal sheets and plates. It permits taking measurements up to 3 1/4 inches from the edge of the work. The heavy-duty ribbed frame has a black, non-slip finish, and the head has a chrome-clad non-glare finish with black-filled graduations and figures. Available with a range of 1 inch in 0.001-inch graduations, and either a plain or ratchet cap.

Circle Item 148 on postcard, page 229



Ingersoll-Rand 75 H.P. Air Compressor Equipped With a 2-feed Madison-Kipp Model SVH Lubricator.

Machines of great performance use the most dependable oiling system ever developed

MADISON-KIPP

Fresh Oil . . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy, where oil under pressure fed drop by drop can be installed. There are 6 models to meet almost every installation requirement.

kipp

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U.S.A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

For more information fill in page number on Inquiry Card, on page 229

"Shure-Set" Fastening Tool

"Shure-Set" manually powered fastening tool introduced by the Ramset Fastening System, Olin Mathieson Chemical Corporation, New York City. With this device, a worker can manually drive a fastener through steel 1/4 inch thick. It is recommended for 158 different light fastening uses employing various types of fasteners. The baseplate is designed to level the tool at right angles to the work and to protect the surface from mis-aimed hammer blows. The neoprene hand grip is comfortable and keeps the hand from sliding. Fingers are protected by the guard at top. The tool is gripped tightly in the center, as shown, and the top rod is hit with a hammer. This action seats the fastener into a variety of materials, including light steel and concrete.

Circle Item 149 on postcard, page 229

Danly Dual Air Valve

Dual air valve of improved design for controlling press operation announced by Danly Machine Specialties, Inc., Chicago, Ill. This valve is specifically designed to actuate the clutch and brake of mechanical power presses. It is said to eliminate accidental stroking due to valve failure. The valve has been simplified, many of its components strengthened, and its over-all size has been reduced. The new construction is said to offer longer operating life, greater accessibility, and easier maintenance than the preceding model.

Circle Item 150 on postcard, page 229

High-Production Reamers

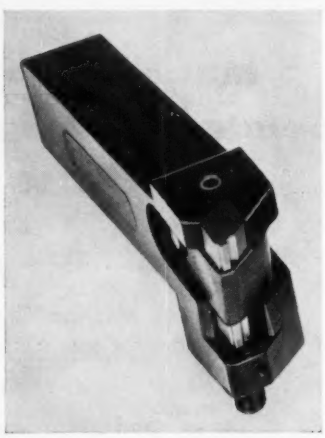
Hercules "Altercut" chucking reamers featuring alternate right- and left-hand spiral cutting edges specifically designed for high-production operations. This construction produces a double cutting action, as each cutting edge is preceded and followed by an edge that cuts at a different angle to the axis of the hole being reamed. It is claimed that the double spiral design prevents chattering, helps relieve strains imposed upon the reamer, and results in less dulling of the cutting edges. Thus, a greatly increased number of accurate, fine-finished holes can be produced between grinds. The "Altercut" reamers offered by Whitman & Barnes, Plymouth, Mich., are available in both high-speed steel and carbide and in straight and taper shank styles. Sizes range from 1/4 inch to 1 1/2 inches in diameter.

Circle Item 151 on postcard, page 229

"Sonobond" Fluxless Soldering Equipment

"Sonobond" Model No. S-O-H-55-12 small hand equipment specifically designed for fluxless soldering of small parts such as encountered in the electronic industry. This equipment is part of a unit recently added to the "Sonobond" line of ultrasonic fluxless soldering outfits made by Aeroprojects, Inc., West Chester, Pa. It will tin silicon, germanium, and a wide variety of non-ferrous metals.

Circle Item 152 on postcard, page 229



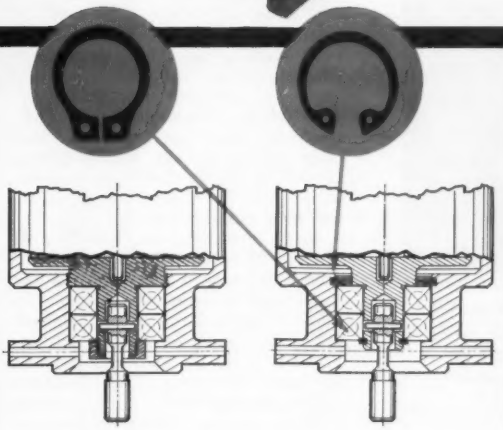
Wesson "Multicut" Carbide-Insert Tool

Indexible carbide-insert "Multicut" tool for all types of shallow grooving cuts introduced by the Wesson Co., Ferndale, Mich. Except for the insert itself and the locking bank of the "Multicut" holder, all parts of the tool are of standard design. It has wide applications in the automotive, electrical, and other fields. The inserts are modified Wessonmetal D-80 and may be used in four positions (two for each end) before they require resharpening.

Circle Item 153 on postcard, page 229

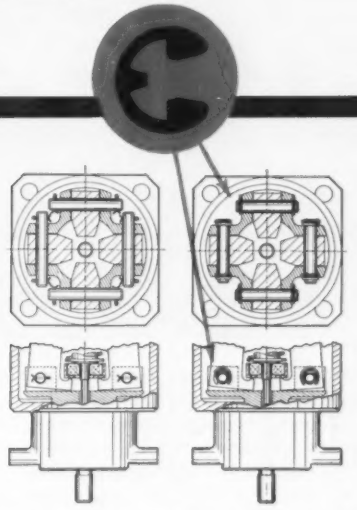
10 Waldes Truarc rings speed assembly— Eliminate parts and machining in precision control

Kahn Rotary Speed Control
Kahn and Company, Inc., of Hartford, Conn., use a total of 10 Waldes Truarc Retaining Rings in this new mechanical-electric translator for automatic control of rotary speed. Truarc rings act as positioners and retainers to eliminate parts, simplify operations, save labor, and speed assembly.



Rotor Installation. In the old way, ball bearing was retained by a threaded shoulder and threaded bearing cup retainer.

New way, using two Truarc Rings (Series 5100 and 5000) eliminates 4 threading operations, bearing shoulder and threaded bearing cup. Assembly is quicker and easier, two ounces lighter.



Flyweight Assembly. Formerly, 2 holes had to be drilled in each of the 4 pivots, and 8 cotter pins were required.

The new way, using 8 Truarc E-Rings (Series 5133), replaces holes with grooves, reduces pivot size, leaves no projecting parts. Rings snap into place, speed assembly time by three minutes per unit.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product...to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types...as many as 97 different sizes within a type...5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today...let our Truarc engineers help you solve design, assembly and production problems...without obligation.

For precision internal grooving and undercutting ... Waldes Truarc Grooving Tool!

Send for new catalog supplement

WALDES
TRUARC®
RETAINING RINGS

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.
Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.
(Please print)

Name.....
Title.....
Company.....
Business Address.....
City.....*Zone*.....*State*.....

MO68

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787. and other U. S. Patents pending. Equal patent protection established in foreign countries.

Brown & Sharpe Establishes Precision Center

At the official opening of the Brown & Sharpe precision center, Henry D. Sharpe, Jr., president, is cutting the ribbon across the doorway; Charles O. Herb, editor of MACHINERY, is seen standing at his left; and George A. Hawkins, director of marketing and sales promotion, is in the foreground

A precision center where the latest developments in metal-working equipment are effectively displayed and operated on typical jobs was officially opened by the Brown & Sharpe Mfg. Co., Providence, R. I., on May 3. This center occupies a large area in one of the main buildings of the plant and provides a pleasing atmosphere of color and convenience for the purpose intended.

There are separate sections for the display of automatic screw machines and hand screw machines; grinding machines; milling machines; and industrial products. Mention was made, at the opening of the center, of the recent rapid expansion in the field of industrial products. In the past nine months, 178 new industrial products have been developed—more than one product for every working day. These products include precision tools, micrometers of every type, dial indicators, granite surface plates, Johansson gage-blocks, electronic measuring equipment, and other measuring tools. Milling cutters, permanent magnet chucks, vises, arbors, and pumps are also on display in the industrial products section.

In the automatic screw machine division, a No. 00 automatic is set up for producing a brass part in nine and three-eighth seconds. The operation includes turning, facing, threading, drilling of two small holes, knurling, and marking. A No. 2G automatic produces the body and cover of an aluminum pillbox simultaneously. This operation includes turning, boring, cutting external and internal threads, knurling, and marking. A No. 4 automatic is set up with Carboloy tools for producing a steel stub shaft from stock 1 3/4 inches in diameter.

A universal machine in the grinding machine section is provided with an Electralign for positive control of the work-table alignment. This machine is designed to operate on an automatic cycle and has a spark timing arrangement. A plain grinding machine, similarly equipped, is demonstrated grinding plug gages within plus or minus 0.000025 inch.

One of the outstanding exhibits of the milling machine section is a Rangemaster universal milling machine which is a sliding-head type of machine. Horizontal, vertical, and angular milling can be performed with one setting of the work. On an Omniversal milling machine, forty-nine different cuts are taken on the work-piece used in the demonstration.

Milling machine section of the newly established Brown & Sharpe precision center

Welsbach High Pressure Service Gas Valve with Revere Arsenical Bronze Stem.

REVERE

Deep-Drilling Brass Rod

Increases Tool Life over 200% for Welsbach

Why not try it yourself?

In the manufacture of valves the Kitson Division of The Welsbach Corporation, Philadelphia, Pa., has to deep-drill brass rod. Originally the rod was free-machining brass. However, when Revere discovered the extent of the drilling it was suggested that our Mixture 252, Deep-Drilling Brass, would be preferable. This was tried, and the machine shop foreman reported that tool life was increased over 200%. In one item it is possible to bore with a single operation, against the former practice of withdrawing the drill three times in order to clear the chips. Revere's Deep-Drilling brass produces very small, easily cleared chips.

Another item is a high pressure gas valve, with a cast body and brass rod stem. The rod was changed to arsenical bronze, which costs a bit more, but it ended flaking and galling between stem and seat, and materially reduced rejects. Still another instance of Revere service concerns a hot water heater relief valve. The original model was cut out of bar stock. We suggested a high leaded brass tube, hexagon outside, round inside. This greatly reduces machining, has a better surface, and a better seat. Costs more by the pound, but saves more by the piece.

Revere salesmen and Technical Advisors are always glad to collaborate in seeking ways to save money and improve products. Perhaps we can help you!

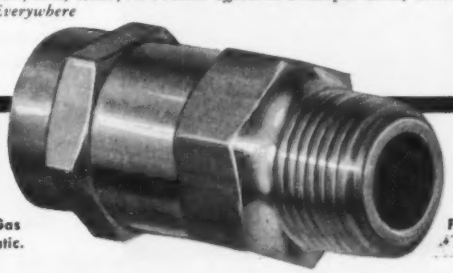
REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere



Welsbach Temperature-Pressure Relief Valve.

Welsbach Emergency Gas Shut-Off Valve, automatic.

Pressure Relief Valve for water heaters.

Between Grinds

By E. S. Salichs

Dial the Operator

According to *Planes*, a wing-building machine tool being used in the manufacture of a giant four-piston-engined airliner is so big that production line workers using it have to communicate by telephone. The tool, called a jig, looks like a huge bridge structure. With the thirteen other precision tools which are needed to make it a complete unit, the device produces wings measuring 150 feet from tip to tip and having a total area of 1850 square feet.

Simply Studding!

Nuts, bolts, and cotter pins are being used by an enterprising young lady to make costume jewelry, and most successfully too. Patricia Smith, who organized the Geomet Co., New York City, uses aluminum precision parts, anodized in exotic colors and strung on round leather machine belting, for her creations.

Welds Whack Clacks

In the future, as you ride in a railroad car placidly gazing at passing scenery, you may suddenly miss the familiar clackety-clack of the wheels on the rails. Railroads are now replacing the traditional 39-foot rails with 78-foot rails (two 39'ers welded together), according to *Steelways*. The welding process and required machinery have been developed by The Linde Air Products Division of Union Carbide and Carbon Corporation. The idea was first suggested in 1820 by a British engineer named Birkenshaw, but at that time there was no way to fuse the rails together.

The Beat of the Building

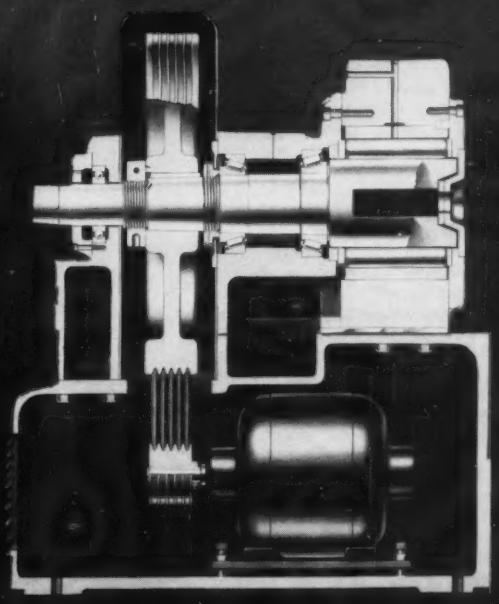
The Empire State Building, now twenty-four years old, had its "pulse," or natural vibration, taken for the first time by Minneapolis-Honeywell engineers who installed an ultra-precise gyroscope on the 85th floor of the 102-story skyscraper, still the world's tallest. Other New York buildings were tested for comparison purposes, and while theirs recorded vibrations as high as fifty times per minute, the "pulse" of the Empire State was between seven to eight times per minute. Verdict: Normal.

Come July, Come MACHINERY'S *Sixteenth Annual Aircraft Number!*

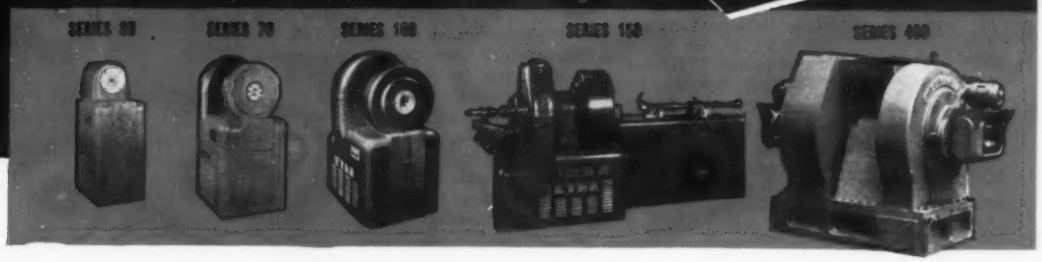
MUSIC IN MACHINERY—The bed of a 750-ton toggle press became the stage for Claire Nunn, a night club entertainer, as she played the piano at an open house held recently by Acme Aluminum Alloys, Inc., Dayton, Ohio. The press was one of several pieces of major equipment installed to convert the company into one of the largest tool and die and special machinery manufacturers in the Middle West. In the change-over, the company's foundry activities were eliminated

IF IT'S SWAGING... It's Etna...

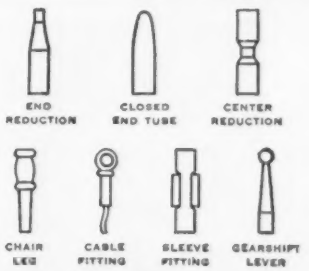
FOR CONTINUOUS PRECISION PRODUCTION!



A COMPLETE RANGE OF SIZES AND CAPACITIES



For tapering, sizing, reducing and forming to special shapes of round solids and steel tubing, the Etna Swaging Machine offers the ultimate in modern machine design. Regardless of size and description of the job to be done, there's an Etna swager right for *greater production*. Write today regarding your specific job problems.



It's New! Get full information on the blending into the wall of I. D. Bead on steel and stainless steel tube with Etna Swagers resulting in mirror finish. Bead also removed on conduit.

Abbey ETNA Company

3422 MAPLEWOOD AVE., TOLEDO 10, OHIO

For more information fill in page number on Inquiry Card, on page 229

News OF THE INDUSTRY

California and Washington

NORTON CO., Worcester, Mass., has opened a new grinding wheel plant at Santa Clara, Calif. This plant is believed to be the only one on the West Coast making a complete line of grinding wheels, including mounted points, segments, and diamond wheels up to 14 inches in diameter. Larger size and special wheels made in the Worcester plant will be stocked. Features of the plant include automatic electric tunnel kilns, dust control equipment, automatic molding machines, and modern handling equipment. GEORGE A. GARRISON is manager of the plant.

BERNARD C. DUNN has been appointed sales engineer, milling machines, of the Axelson Mfg. Co. Division of U. S. Industries, Inc., Los Angeles, Calif. Prior to joining the company, Mr. Dunn was associated with the Diamond Machine Tool Co.

HOWARD A. STAI was appointed manager of tubular steel products and cold-finished bar sales at the Seattle steel service plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill. Mr. Stai has been with the company since 1949. From a supervisory position in the tubular steel products sales division, he became a sales representative selling the company's full line of steel in 1954. He continued in this post until his present appointment.

Howard A. Stai, manager of tubular steel, Joseph T. Ryerson & Son, Inc.

Illinois and Wisconsin

BORG-WARNER CORPORATION, Chicago, Ill., announces the following personnel changes: ROBERT S. INGERSOLL was elected president. He was previously an administrative vice-president. ROY C. INGERSOLL, formerly chairman of the board and president, was re-elected board chairman and named chief executive officer, but relinquished the presidency which he has held for six years. LESTER G. PORTER, previously administrative vice-president, was elected to the newly created position of executive vice-president. ALBERT STEG, formerly treasurer and controller, was named financial vice-president and treasurer. ROBERT W. MURPHY, vice-president and general counsel, was given the additional responsibility of vice-chairman of the Executive Committee. Messrs. Robert S. Ingersoll, Porter, Murphy, and Steg were elected last year to the board of directors. Roy C. Ingersoll has been a director since 1930.

THOR POWER TOOL CO., Aurora, Ill., has opened a Kansas City factory sales and service branch at 606 W. 17th St. The site will serve as sales and service headquarters for distributors and users of the company's power tools in Kansas and Oklahoma and parts of Iowa, Missouri, Nebraska, as well as Texas. At the same time, plans were announced for the construction of a new plant that will triple the production of the company's Speedway Mfg. Co. division. A 15-acre industrial site at LaGrange Park, Ill., a western suburb of Chicago a few miles from the present Speedway plant, has been earmarked for the new structure.

WHEELCO INSTRUMENT DIVISION, Barber-Colman Co., Rockford, Ill., announces the following expansion of sales and service facilities: A branch office has been established in Houston, Tex., with WILLIAM THORRAT as manager. HAROLD S. HERN has joined the sales service staff in Baltimore. In Boston, the new sales engineer is JOHN C. TWOMEY. The new sales engineers in Chicago are WALTER A. WHITE and ROBERT G. STEEL. TOM J. CHAKOS has also joined the Chicago sales organization. The Los Angeles office has added HENRY T. CLINKABERRY and ROBERT D. GETZELMAN as service engineers, and CHARLES E. MCGOFF is associated with the St. Louis office in the same capacity.

DALE L. BENNETT has been appointed superintendent of the Tool and Machine Mfg. Division, Acme Steel Co., Chicago, Ill. Mr. Bennett joined the company in 1947 as supervisor of tooling and process. He was appointed assistant superintendent of the Tool & Machine Mfg. Division in 1950.

L. J. LIEBERTHAL has been appointed general manager of the Conduit Fittings Corporation, Chicago, Ill., a division of U. S. Industries, Inc. Mr. Lieberthal succeeds M. J. WEISS, who resigned as general manager.

DR. SEVERIN RAYNOR has been appointed director of American Machine & Foundry Co., Mechanics Research Department, Chicago, Ill.

JOHN R. DAVEY was appointed manager of the metallurgical department of the Acme Steel Co., Chicago, Ill.

KEARNEY & TRECKER CORPORATION, Milwaukee, Wis., announces the appointment of CHARLES M. KINGSBURY as West Coast district manager. He succeeds FRANK RIFFLE, who retired after twenty-three years with the company. WILLIAM HEIM replaces Mr. Kingsbury as service engineer.

Michigan

VICKERS, INCORPORATED, Detroit, Mich., announces the following appointments: THOMAS B. DOE, JR., has been named manager of export sales. He will be responsible for the consolidation of all export sales activities involving aircraft, industrial, and mobile equipment. RUSSELL DUPUIS was appointed plant manager of the Omaha Production Division. Mr. Dupuis will be responsible for all activities of the Omaha Division where components for oil-hydraulic systems are manufactured.

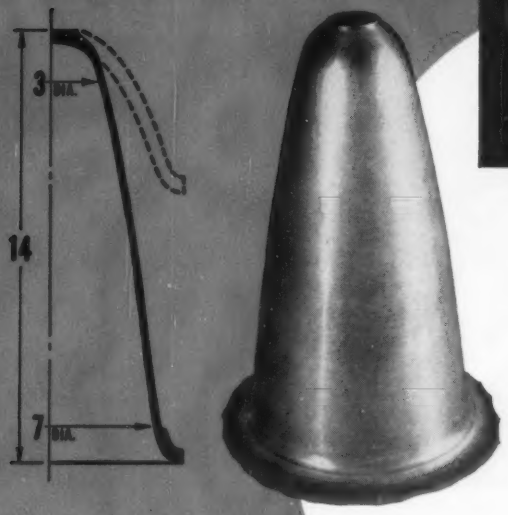
MUELLER BRASS CO., Port Huron, Mich., announces the following appointments: RICHARD J. WILLIAMS—sales representative for the Dallas, Texas, territory, where he will assist NORMAN COOPER. WILLIAM A. PREININGER—district manager of the Denver, Colo., sales territory. GEORGE I. DUDDY—sales representative attached to the Cincinnati, Ohio, office. JOHN G. DENARDIN, sales representative assigned to the Indianapolis, Ind., office.

HENRY M. WOOD has been elected to the board of directors of the Ross Operating Valve Co., Detroit, Mich. Mr. Wood has been a representative of the company since 1940.

(Continued on page 252)

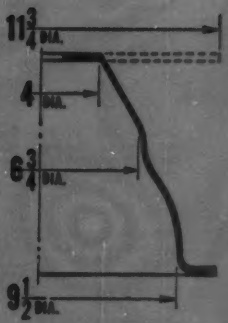
HEMISPHERES TO 38" DIAMETER,

with 3/16" max. wall thickness, are readily formed on the Cincinnati Hydrospin. Part wall can be tapered or have constant thickness. The starting blank is a flat disk or dished preform. Almost any ductile metal can be used. Other machines available for parts and hemispheres larger than 38".



PARABOLIC-SHAPED PART

formed in one pass in two minutes. Starting blank of 61 SO aluminum, 11 3/8" dia. x 3/16" thick, was preformed on a Cincinnati Hydroform.



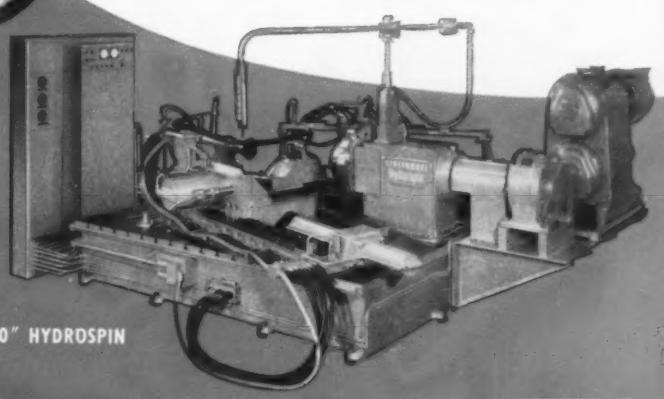
COMPOUND CONTOURS

of this part were formed in one pass in one minute. Material is mild steel.

complicated contours cost less by Hydrospinning!

The parts shown here were formed by *tracer* Hydrospinning at substantial reduction in cost over that of previous production methods. These parts were produced in far less time . . . are more accurate . . . have increased strength with greater resistance to fatigue failure . . . required less material . . . and were made without compromising on material requirements.

If difficult-to-form contoured components are one of your production headaches, get the facts on Hydrospinning. Call in a Cincinnati Milling field engineer. For a detailed description of the process and machine specifications, write for new Bulletin M-1873-2.



CINCINNATI 42" x 50" HYDROSPIN

CINCINNATI **Hydrospin**

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

Warranty: 16 oz. of First Quality in every pound!

DIE STEELS FOR HOT WORK

Produced by Vanadium-Alloys Steel Company to *first quality* metallurgical and performance standards, these die steels match every hot work need in the metal-forming industries. They are the specialized products of tool steel specialists, made in a plant devoted exclusively to fine tool steels. Let our district sales engineers aid you in selection and application—their trained services are yours without obligation of any kind.

Hotform — The most widely used of all hot work die steels. 5% chromium—tops in strength and toughness, plus resistance to heat checking. Use for die casting, extrusion and hot forging dies, backer blocks, mandrels, etc.

Hotpress — Tungsten Die Steel with additional toughness for high temperature work. Outstanding on dummy blocks for brass extrusion, upsetting dies, extrusion dies, and press dies.

SC Special — 14% Tungsten Die Steel with increased carbon for better wearing properties. Particularly adapted for extrusion punches, piercers, and forming dies.

Marvel — 10% Tungsten Hot Work Die Steel for tools requiring better resistance to high temperatures. Excellent for punches, nut piercers and dies, and brass forging dies.

Red Cut Superior J Temper — Tungsten High Speed Die Steel for high temperature service, having excellent hot hardness properties and wear resistance. Outstanding on extrusion dies, hot press dies, trimming dies, and punches.

Forge-Die — 14% Tungsten Hot Work Steel, having high resistance to softening at elevated temperatures. Recommended for piercers, punches, and hot forming dies.

WW Hotwork — High Alloy Steel developed for maximum wear resistance at elevated temperatures. Used for copper and brass extruding dies, brass die casting dies, piercers for copper tubing, and nozzles on zinc die casting machines.

WCC — New, very deep hardening tungsten, chromium, cobalt and vanadium steel—outperforming 9.50 tungsten types. High resistance to wear and thermal fatigue. Use for hot extrusion dies, permanent molds for brass casting, forging die inserts, hot-press dies.

Vanadium-Alloys Steel Company

Latrobe, Pennsylvania

SUBSIDIARIES: Colonial Steel Co. • Anchor Drawn Steel Co. • Pittsburgh Tool Steel Wire Co.
Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni

AMERICAN STANDARD WRENCH OPENINGS

Nominal Size of Wrench, also Basic or Maximum Width Across Flats of Bolt and Screw Heads and Nuts		Allowance between Bolt Head or Nuts and Jaws of Wrench	Wrench Openings			NUTS			BOLTS AND SCREWS				NUTS
						Finished Hex, Hex-Jam, Hex-Slotted, Hex-Thick, Hex-Thick Slotted and Hex-Castle	Regular Square, Hex, Hex-Jam, Semi-Fin. Hex, Hex-Jam and Hex-Slotted	Heavy Square, Hex, Hex-Jam Semi-Fin. Hex, Hex-Jam and Hex-Slotted	Finished and Regular Bolts Square, Hex, Semi-Fin. Hex Hex Head Cap Screws	Heavy Bolts Hex, Semi-Fin. Hex, and Finished Hex	Lag Bolts Square	Set Screws Square	Machine Screw and Stove Bolt Nuts
			Min.	Tol.	Max.								
5/32	0.1562	0.002	0.158	0.005	0.163								No. 0 & No. 1
3/16	0.1875	0.002	0.190	0.005	0.195							No. 10	No. 2 & No. 3
7/32	0.2187	0.002	0.220	0.005	0.225							No. 12	
1/4	0.2500	0.002	0.252	0.005	0.257							1/4	No. 4
9/32	0.2812	0.002	0.283	0.005	0.288						No. 10		
5/16	0.3125	0.003	0.316	0.006	0.322							5/16	No. 5 and No.6
11/32	0.3438	0.003	0.347	0.006	0.353								No. 8
3/8	0.3750	0.003	0.378	0.006	0.384				1/4*		1/4	3/8	No. 10
7/16	0.4375	0.003	0.440	0.006	0.446	1/4	1/4		1/4			7/16	No.12 and 1/4
1/2	0.5000	0.004	0.504	0.006	0.510	5/16		1/4	5/16		5/16	1/2	
9/16	0.5625	0.004	0.566	0.007	0.573	3/8	5/16	5/16	3/8		3/8	9/16	5/16
5/8	0.6250	0.004	0.629	0.007	0.636		3/8		7/16		7/16	5/8	3/8
11/16	0.6875	0.004	0.692	0.007	0.699	7/16		3/8					
3/4	0.7500	0.005	0.755	0.008	0.763	1/2	7/16	7/16	1/2		1/2	3/4	
13/16	0.8125	0.005	0.818	0.008	0.826		1/2		9/16				
7/8	0.8750	0.005	0.880	0.008	0.888	9/16	9/16	1/2		1/2		7/8	
15/16	0.9375	0.006	0.944	0.009	0.953	5/8		9/16	5/8		5/8		
1	1.0000	0.006	1.006	0.009	1.015		5/8					1	
1 1/16	1.0625	0.006	1.068	0.009	1.077			5/8		5/8			
1 1/8	1.1250	0.007	1.132	0.010	1.142	3/4	3/4		3/4		3/4	1 1/8	
1 1/4	1.2500	0.007	1.257	0.010	1.267			3/4		3/4		1 1/4	
1 5/16	1.3125	0.008	1.320	0.011	1.331	7/8	7/8		7/8		7/8		
1 3/8	1.3750	0.008	1.383	0.011	1.394							1 3/8	
1 7/16	1.4375	0.008	1.446	0.011	1.457			7/8		7/8			
1 1/2	1.5000	0.008	1.508	0.012	1.520	1	1		1		1	1 1/2	
1 5/8	1.6250	0.009	1.634	0.012	1.646			1		1			
1 11/16	1.6875	0.009	1.696	0.012	1.708	1 1/8	1 1/8		1 1/8		1 1/8		
1 13/16	1.8125	0.010	1.822	0.013	1.835			1 1/8		1 1/8			
1 7/8	1.8750	0.010	1.885	0.013	1.898	1 1/4	1 1/4		1 1/4		1 1/4		
2	2.0000	0.011	2.011	0.014	2.025			1 1/4		1 1/4			
2 1/16	2.0625	0.011	2.074	0.014	2.088	1 3/8	1 3/8		1 3/8				
2 3/16	2.1875	0.012	2.200	0.015	2.215			1 3/8		1 3/8			
2 1/4	2.2500	0.012	2.262	0.015	2.277	1 1/2	1 1/2		1 1/2				
2 3/8	2.3750	0.013	2.388	0.016	2.404			1 1/2		1 1/2			
2 7/16	2.4375	0.013	2.450	0.016	2.466	1 5/8	1 5/8		1 5/8				
2 9/16	2.5625	0.014	2.576	0.017	2.593			1 5/8		1 5/8			
2 5/8	2.6250	0.014	2.639	0.017	2.656	1 3/4	1 3/4		1 3/4				
2 3/4	2.7500	0.014	2.766	0.017	2.783			1 3/4		1 3/4			
2 13/16	2.8125	0.015	2.827	0.018	2.845	1 7/8	1 7/8		1 7/8				
2 15/16	2.9375	0.016	2.954	0.019	2.973			1 7/8		1 7/8			
3	3.000	0.016	3.016	0.019	3.035	2	2		2				
3 1/8	3.1250	0.017	3.142	0.020	3.162			2		2			
3 3/8	3.3750	0.018	3.393	0.021	3.414	2 1/4	2 1/4		2 1/4				
3 1/2	3.5000	0.019	3.518	0.022	3.540			2 1/4		2 1/4			
3 3/4	3.7500	0.020	3.770	0.023	3.793	2 1/2	2 1/2		2 1/2				
3 7/8	3.8750	0.020	3.895	0.023	3.918			2 1/2		2 1/2			
4 1/8	4.1250	0.022	4.147	0.025	4.172	2 3/4	2 3/4		2 3/4				
4 1/4	4.2500	0.022	4.272	0.025	4.297			2 3/4					
4 1/2	4.5000	0.024	4.524	0.026	4.550	3	3		3				
4 5/8	4.6250	0.024	4.649	0.027	4.676			3		3			
4 7/8	4.8750	0.025	4.900	0.028	4.928								
5	5.0000	0.026	5.026	0.029	5.055			3 1/4					
5 1/4	5.2500	0.027	5.277	0.030	5.307			3 1/2					
5 3/8	5.3750	0.028	5.403	0.031	5.434			3 1/2					
5 5/8	5.6250	0.029	5.654	0.032	5.686			3 3/4					
5 3/4	5.7500	0.030	5.780	0.033	5.813			3 3/4					
6	6.0000	0.031	6.031	0.034	6.065			4					
6 1/8	6.1250	0.032	6.157	0.035	6.192			4					

All dimensions given in inches.

*Regular square only.

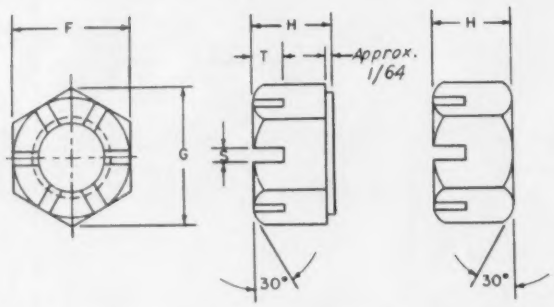
Wrenches shall be marked with the "Nominal Size of Wrench" which is equal to the basic or maximum width across flats of the corresponding bolt head or nut.

Allowance (minimum clearance) between maximum width across flats of nut or bolt head and jaws of wrench equals (0.005 W + 0.001). Tolerance on wrench opening equals plus (0.005 W + 0.004 from minimum). (W equals nominal size of wrench.)

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

MACHINERY'S DATA SHEET

AMERICAN STANDARD HEAVY SEMIFINISHED HEXAGON SLOTTED NUTS



Nominal Size or Basic Major Diameter of Thread	Width Across Flats F		Width Across Corners G		Thickness H			Slot	
	Max. (Basic)	Min.	Max.	Min.	Nom.	Max.	Min.	Width S	Depth T
1/4 0.2500	1/2 0.5000	0.488	0.577	0.556	15/64	0.250	0.218	0.078	0.094
5/16 0.3125	9/16 0.5625	0.546	0.650	0.622	19/64	0.314	0.280	0.094	0.094
3/8 0.3750	11/16 0.6875	0.669	0.794	0.763	23/64	0.377	0.341	0.125	0.125
7/16 0.4375	3/4 0.7500	0.728	0.866	0.830	27/64	0.441	0.403	0.125	0.156
1/2 0.5000	**7/8 0.8750**	**0.850**	**1.010**	**0.969**	**31/64**	**0.504**	**0.464**	0.156	0.156
9/16 0.5625	15/16 0.9375	0.909	1.083	1.037	35/64	0.568	0.526	0.156	0.188
5/8 0.6250	**1 1/16 1.0625**	**1.031**	**1.227**	**1.175**	**39/64**	**0.631**	**0.587**	0.188	0.219
3/4 0.7500	**1 1/4 1.2500**	**1.212**	**1.443**	**1.382**	**47/64**	**0.758**	**0.710**	0.188	0.250
7/8 0.8750	**1 7/16 1.4375**	**1.394**	**1.660**	**1.589**	**55/64**	**0.885**	**0.833**	0.188	0.250
1 1.0000	**1 5/8 1.6250**	**1.575**	**1.876**	**1.796**	**63/64**	**1.012**	**0.956**	0.250	0.281
1 1/8 1.1250	**1 13/16 1.8125**	**1.756**	**2.093**	**2.002**	**1 7/64**	**1.139**	**1.079**	0.250	0.344
1 1/4 1.2500	**2 2.0000**	**1.938**	**2.309**	**2.209**	**1 7/32**	**1.251**	**1.187**	0.312	0.375
1 3/8 1.3750	**2 3/16 2.1875**	**2.119**	**2.526**	**2.416**	**1 11/32**	**1.378**	**1.310**	0.312	0.375
1 1/2 1.5000	**2 3/8 2.3750**	**2.300**	**2.742**	**2.622**	**1 15/32**	**1.505**	**1.433**	0.375	0.438
1 3/4 1.7500	**2 3/4 2.7500**	**2.662**	**3.175**	**3.035**	**1 23/32**	**1.759**	**1.679**	0.438	0.500
2 2.0000	**3 1/8 3.1250**	**3.025**	**3.608**	**3.449**	**1 31/32**	**2.013**	**1.925**	0.438	0.562
2 1/4 2.2500	3 1/2 3.5000	3.388	4.041	3.862	2 13/64	2.251	2.155	0.438	0.562
2 1/2 2.5000	3 7/8 3.8750	3.750	4.474	4.275	2 29/64	2.505	2.401	0.562	0.688
2 3/4 2.7500	4 1/4 4.2500	4.112	4.907	4.688	2 45/64	2.759	2.647	0.562	0.688
3 3.0000	4 5/8 4.6250	4.475	5.340	5.102	2 61/64	3.013	2.893	0.625	0.750
3 1/4 3.2500	5 5.0000	4.838	5.774	5.515	3 3/16	3.252	3.124	0.625	0.750
3 1/2 3.5000	5 3/8 5.3750	5.200	6.207	5.928	3 7/16	3.506	3.370	0.625	0.750
3 3/4 3.7500	5 3/4 5.7500	5.562	6.640	6.341	3 11/16	3.760	3.616	0.625	0.750
4 4.0000	6 1/8 6.1250	5.925	7.073	6.755	3 15/16	4.014	3.862	0.625	0.750

All dimensions given in inches.

Bold type indicates products unified dimensionally with British and Canadian standards.

Semifinished nuts are finished on bearing surface and threaded.

Taper of the sides of nuts (angle between one side and the axis) shall not exceed 2 degrees, the specified width across flats being the largest dimension.

Tops of nuts shall be flat and chamfered. Diameter of top circle shall be the maximum width across flats within a tolerance of minus 15 per cent for washer-faced nuts and within a tolerance of minus 5 per cent for double-chamfered nuts.

Bearing surface shall be washer-faced or have chamfered corners. Diameter of washer face and the diameter of circle of bearing surface of double-chamfered nuts shall be the maximum width across flats within a tolerance of minus 5 per cent. Tapped hole shall be countersunk 1/64 inch over the major diameter of thread for nuts up to and including 1/2 inch, and 1/32 inch over the major diameter of thread for nuts over 1/2 inch size.

Bearing surface shall be at right angles to the axis of the threaded hole within a tolerance of 2 degrees for 5/8-inch nuts or smaller, and 1 degree for nuts larger than 5/8 inch; therefore, the maximum total run-out of bearing face would equal the tangent of specified angle times the distance across flats.

Slots may have square or round bottom at option of manufacturer.

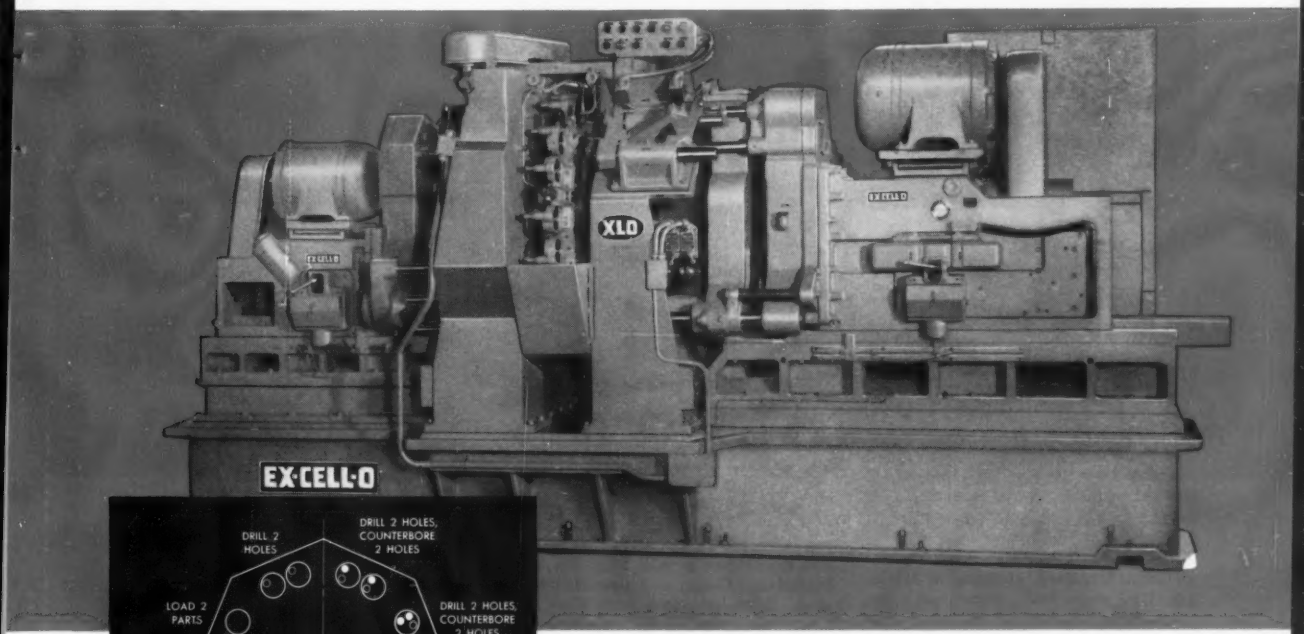
Thread may be coarse-, fine-, or 8-thread series of Class 2B tolerance; unless otherwise specified, coarse-thread series will be furnished.

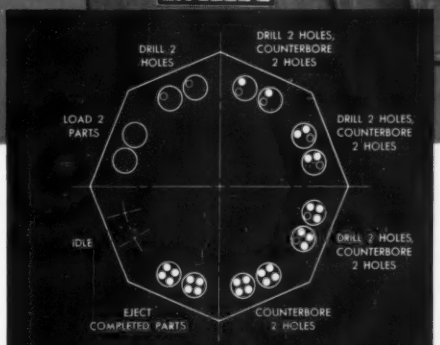
Suitable material for steel nuts is covered by ASTM A-307; other materials will be as agreed upon by manufacturer and user.

Extracted from American Standard Square and Hexagon Bolts and Nuts (ASA B18.2-1955), with the permission of the publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

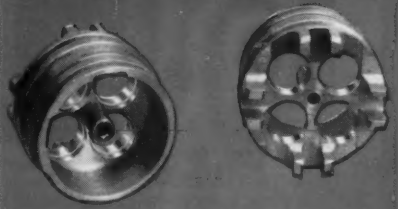
SPECIAL EX-CELL-O MACHINE

Drills and Counterbores 514 Rocket Nozzles per Hour





This diagram shows the progressive operations. At station 7, parts are automatically ejected.



Front and rear view of completed part. The rocket nozzle is tough forged steel; location of holes to each other and to the four pronged slots is critical.

Here's another Ex-Cell-O solution to a hard-to-handle machining job. Rocket nozzles are small, tough steel forgings. For the drilling and counterboring operations—shown in diagram—critical dimensions must be held.

Ex-Cell-O designed and built this special machine with a trunnion fixture that indexes through eight stations. Two Standard Ex-Cell-O Slide Type Hydraulic Power Units—one for drilling, the other for counterboring—actuate the multiple spindle heads. Features of the machine include simplified design, high productivity, safety and sturdiness. . . . When you're faced with a tough machining problem, call in Ex-Cell-O.

XLO
EX-CELL-O for PRECISION

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-28

(Left) Marvin R. Anderson, president; and (right) Oscar L. Bard, chairman of the board, of Michigan Tool Co.

MICHIGAN TOOL CO., Detroit, Mich., announces the following appointments: MARVIN R. ANDERSON was named president, succeeding OSCAR L. BARD who moves up to the position of chairman of the board. Mr. Anderson, a son of one of the founders of Michigan Tool, has been with the company since 1935. He has been executive vice-president for the last twelve years. For the last year, he has also been president of the American Gear Manufacturers Association. Mr. Bard, president of Michigan Tool since 1940, started with the company forty years ago. The company also announces the formation of its Gear-O-Mation Division at 17140 E. Ten Mile Road, East Detroit, to design and build automation equipment for high-volume manufacturing of gears and other small parts of similar size and contour. FRED T. PROPER has been named sales manager for the new division. He was formerly sales manager of the Manistee Iron Works Division. F. ZAWASKI and JOSEPH ZELD have been appointed supervisor of engineering and supervisor of manufacturing and erections, respectively.

CARBOLOY DEPARTMENT of the General Electric Co., Detroit, Mich., announces that its Pacific district offices have moved to 2106 W. Washington Blvd., Los Angeles, Calif. At the same time, it was announced that JACK A. YOBLIN was appointed carbide products development engineer.

PHILIP R. SMITH has been appointed assistant manager of the Sheffield Michigan Sales Corporation, Detroit, Mich., a branch sales office of the Sheffield Corporation, Dayton, Ohio.

PRESSED METALS OF AMERICA, INC., Port Huron, Mich., and AMERICAN BANTAM CAR CO., Butler, Pa., announce jointly the merger of Pressed Metals of America, Inc., into American Bantam Car Co., Butler, Pa.

New England

ROBERT P. MARKS was appointed field sales representative of the ALLEN MFG. CO., Hartford, Conn. He will represent the socket screw manufacturing company in San Francisco and the Northwest with company offices at 24 California St., San Francisco, Calif.

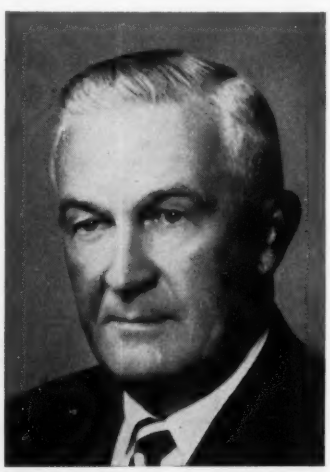
SELDEN T. WILLIAMS, vice-president and director of Scovill Mfg. Co., Inc., Waterbury, Conn., and general manager of A. Schrader's Son, Inc., New York City, was elected president of A. Schrader's Son, Inc. He is also president and treasurer of Schrader-Scovill Co., Proprietary Ltd., Australia. Mr. Williams joined the company in 1929 and was appointed vice-president of Scovill Mfg. Co., Inc., in charge of manufacturing of Schrader domestic and foreign plants in 1944.

Selden T. Williams, president of A. Schrader's Son, Inc.

Fred T. Proper, sales manager of Gear-O-Mation Division

NELCO TOOL CO., Manchester, Conn., manufacturer of carbide-tipped tools, announces the appointment of the F. HALLOCK CO., 116 Main St., Derby, Conn., as the authorized distributor of Nelco carbide tools in the New Haven area.

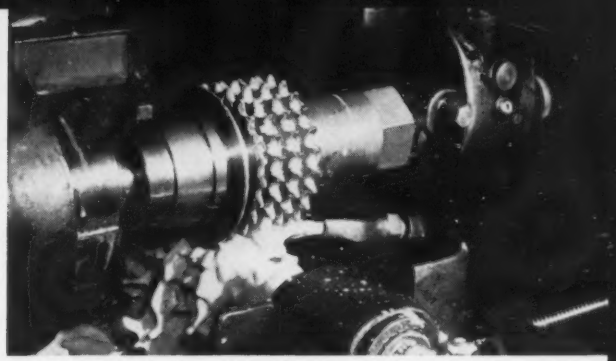
CLARENCE G. ROSENSWEIG was elected president of the Fafnir Bearing Co., New Britain, Conn., following the retirement of board chairman MAURICE STANLEY and the elevation of president STANLEY M. COOPER to the chairman's post. RICHARD F. COOPER was elected vice-president in charge of manufacturing. Mr. Rosensweig has been associated with Fafnir since 1916. He formerly served as executive vice-president.



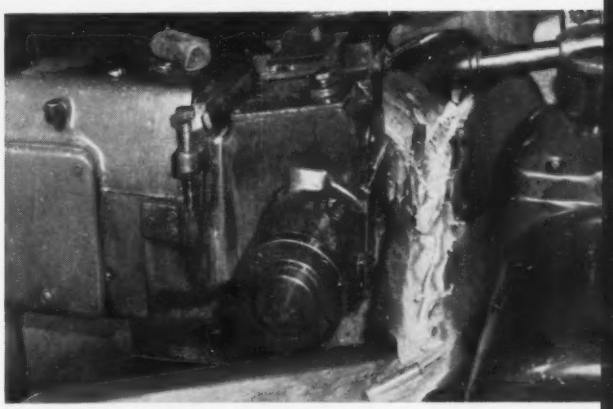
Clarence G. Rosensweig, newly appointed president of Fafnir Bearing Co.

(*Continued on page* 256)

TURNING AND DRILLING. During the machining of a 9-in. piece using carbide-tipped tools, S.E.C.O. removes heat fast ...assures long runs, top speeds.

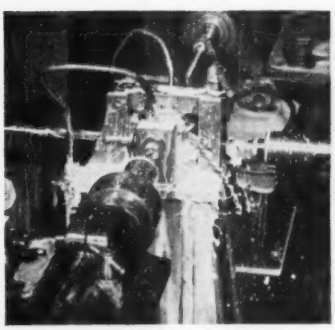


HOBBING. Flooding the cutting edges of a high-speed-steel hob working 1117 steel, S.E.C.O. provides lubricity and cooling power needed for long tool life.



CENTERLESS GRINDING. In grinding 4320 H steel pins, S.E.C.O. keeps wheels clean. Grinding dirt drops out quickly...is not recirculated. Parts are rust-protected.

SUNOCO EMULSIFYING CUTTING OIL HANDLES 4 TOUGH JOBS...EASILY



DRILLING AND REAMING. On steel forgings with a 350/400 Brinell, S.E.C.O. keeps drills cool...gives clean cutting.

Whether you are shaping, hobbing, grinding, reaming, boring or milling, it will pay you to look into the advantages of SUNOCO EMULSIFYING CUTTING OIL.

Moderately priced, S.E.C.O. has been industry's most widely used soluble cutting oil for years. Higher-than-ever machining efficiency, increased detergency, easier mixing, and other added advantages are helping keep S.E.C.O. the leading emulsifying cutting oil in the country today.

For complete information about S.E.C.O. see your Sun representative. Address SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-6.

INDUSTRIAL PRODUCTS DEPARTMENT

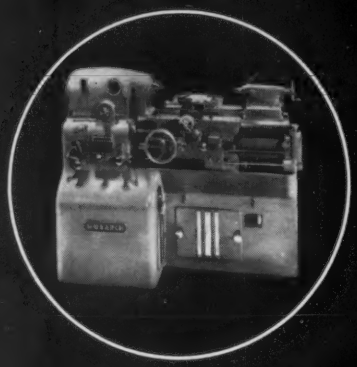
SUN OIL COMPANY

Philadelphia 3, Pa.

IN CANADA: SUN OIL COMPANY, LIMITED, TORONTO AND MONTREAL

SUNOCO®

For more information fill in page number on Inquiry Card, on page 229



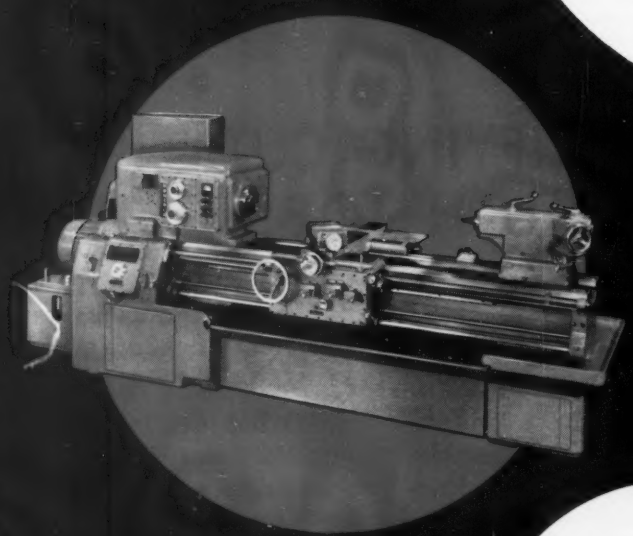
10" Model EE
Sensitive Precision
Toolmakers Lathe

What's your spot? —

Monarch Lathes are used successfully and widely in

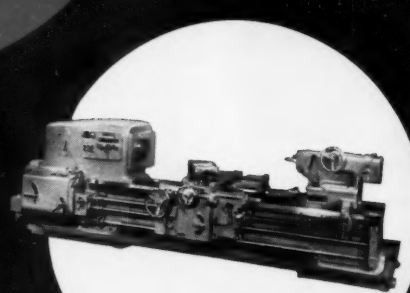
Maintenance Departments
Toolrooms
Experimental Shops
New Development Laboratories
Small Machine Shops
(special equipment for your plant)

in addition to direct large and small lot manufacturing operations.



Series 62
Pre-Selector
Dyna-Shift Lathe

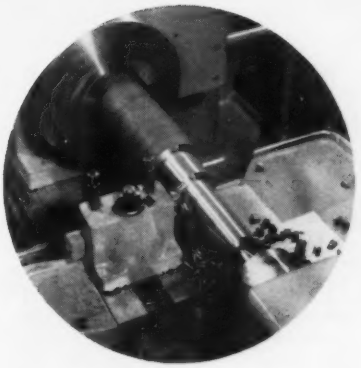
Series 90
Heavy Duty
Dyna-Shift Lathe



Series 61
Engine Lathe

THERE'S A SPOT FOR MONARCH LATHES

wherever metal is turned



And "wherever" is in many industries such as these!

Beverages	Optical
Buttons	Paper
Carpet	Plastics
Cement	Publishing
Chemical & Dye	Rubber
Confectionery	Soap
Drugs	Sugar
Foods	Textiles
Glass	Tile
Lumber	Tobacco
Mining & Refining	Transportation
Motion Picture	Utilities
Oil	

Yes, when it comes to keeping the wheels of the basic process and service industries turning, Monarch lathes play as vital a role as they do in the metal turning industry's tool rooms and production lines. Here, their job is to keep other machines functioning without failure, at a profit. Or to serve in their improvement.

So the same qualities that make all Monarch lathes first choice in the production turning field make many Monarch models equally important to almost every industry regardless of product. You want economy of operation, high degree of accuracy, utter reliability, bold engineering. You'll find all this in the Monarch models pictured here—and others . . . . . **The Monarch Machine Tool Company, Sidney, Ohio.**

Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH

For All Users Monarch Lathes Offer These Advantages

1. Built-in versatility for a wide variety of turning, boring, facing and threading operations.

2. A vast selection of supplementary equipment for unusual or difficult work requirements.

3. High speed for the efficient handling of *all* work within the capacity of each machine.

4. Power for heavy cuts *plus* fingertip speed control to assure maximum tool life on all cuts.

5. Long, trouble-free life based on sound design and on manufacturing techniques which have served industry well since 1909.

6. Accuracy of performance which can come only from one of the world's most modern machine tool plants whose only purpose is and always has been to produce the finest in precision lathes.

STERLING DIE DIVISION of the Pratt & Whitney Co., Inc., West Hartford, Conn., announces plans to erect a new factory in the suburban area of Cleveland, Ohio.

FARREL-BIRMINGHAM CO., INC., Ansonia, Conn., announces that its Chicago office has moved to larger quarters at 10725 S. Western Ave.

JOHN A. MARSH has been named vice-president in charge of air and hydraulic sales by Rivett Lathe & Grinder, Inc., Boston, Mass. Mr. Marsh has been with the company since 1950 as

John A. Marsh, vice-president, Rivett Lathe & Grinder, Inc.

sales manager of the Air and Hydraulic Division. Mr. Marsh is a director of the Fluid Power Association, having been one of the organizers of that group which represents all prominent companies engaged in the field of air and hydraulics.

REED ROLLED THREAD DIE CO., Worcester, Mass., announces the appointment of LEE HORNEYER CO., 7 North Grand Blvd., St. Louis, Mo., as its representative, covering eastern Missouri and southern Illinois.

NORTON CO., Worcester, Mass., announces the following appointments: SIDNEY B. WETHERHEAD has been named manager of distributor sales promotion, a newly created post. Mr. Wetherhead was formerly an abrasive engineer in the Boston area. ROBERT H. CANNON retired as merchandising engineer after forty years with the company. The responsibility of the merchandising engineering department will be taken over by ELLIOTT D. LINTON, who has been with the company since 1920. GORDON F. COLSON has been appointed a field engineer at the company's Huntington Park, Calif., office. Mr. Colson formerly served as a field engineer at the company's Chicago district office.

New York

GENERAL ELECTRIC CO., Schenectady, N. Y., announces the following appointments: SIMON J. TOMBAUGH has been named manager of the east central district of the company's User Industries Sales Department with headquarters in Cleveland, Ohio. He succeeded EDWIN H. HOWELL, who has been elected a commercial vice-president with headquarters in Dallas, Tex. JOHN T. STONE will succeed Mr. Tombaugh as manager of user industries sales in the Indianapolis area. The department is a part of the company's Apparatus Sales Division with headquarters in New York City.

CHARLES L. HOLBERT has been appointed executive vice-president of H. K. Porter Co., Inc., New York City. Mr. Holbert, who will be operating head of the company, succeeds CLARENCE R. DOBSON, who retired. Mr. Dobson, who joined the company in 1946, will serve as consultant. At the same time, it is announced that CARL J. SIEBERT has been appointed sales manager of the company's W-S Fittings Division, Roselle, N. J.

DONALD P. GARDNER was appointed field sales engineer of the Loewy-Hydropress Division of Baldwin-Lima-Hamilton, New York City. He will maintain headquarters in Detroit and Michigan, and will represent the company in Michigan and western Ohio. He has been associated with the automotive and aircraft industries for twenty-five years.

MALCOLM P. HERRICK has been appointed staff assistant to JOHN H. VOSS, vice-president in charge of the Telephone Division of STROMBERG-CARLSON, a division of General Dynamics Corporation, Rochester, N. Y. He has been with the company since 1944.

AMERICAN CAR & FOUNDRY DIVISION of ACF Industries, Inc., New York City, announces the appointment of HERBERT H. ROGGE as executive vice-president.

Ohio

TIMKEN ROLLER BEARING CO'S STEEL & TUBE DIVISION has announced the promotion of ROSS HERSHEY, formerly a sales engineer in the company's Detroit office, to the position of district sales manager in the Buffalo district. R. P. DONNELL was made district manager in New York City. WYN MCCOY, formerly district manager, has been promoted to sales promotion manager, Industrial Division at Canton, Ohio.

NATIONAL ACME CO., Cleveland, Ohio, announces the appointment of WILLIAM E. BOUR to the newly created position of manager of the company's Threading Tools Division. He will be responsible for the coordination of all the departments in this division. Mr. Bour, who joined the company in 1945, has served as a sales specialist in the Cleveland and Buffalo territories.

LEONARD A. RAFFERTY has been appointed manager of the Pittsburgh office of the Motch & Merryweather Co., Cleveland, Ohio. Mr. Rafferty, who was assistant manager for the last six years, succeeds J. T. MCCUEN who will continue in a sales consultant capacity in the Pittsburgh office.

RELIANCE ELECTRIC & ENGINEERING CO., Cleveland, Ohio, announces the appointment of the following sales engineers: T. R. MAHONEY to the Newark, N. J., office; F. G. GRISWOLD to Cincinnati; L. L. SEWARD to Baltimore; and J. R. PERAMPLE to Detroit.

ROBERT W. MILLER, a specialist in the field of induction heating, has joined the Process Machinery Division of the Cincinnati Milling Machine Co., Cincinnati, Ohio.

Pennsylvania

WILLIAM H. MUCHNIC, president of Locomotive Finished Materials (or LFM) Co., Atchison, Kan., which merged with Rockwell Mfg. Co., Pitts-

William H. Muchnic, a director of Rockwell Mfg. Co.

burgh, Pa., has been elected a director of Rockwell. He joined the LFM company as plant engineer in 1946 and was elected assistant to the president in 1948. He became president in 1952.

SHARON STEEL CORPORATION, Sharon, Pa., announces the following appointments: JAMES STEELE has been appointed assistant manager of stainless and alloy steel sales. RICHARD CONNELL has been promoted to a new position in the customer service department. PAUL JOHNSON has been named sales representative in the Sharon district sales office. KENNETH LIVINGSTON will take up new duties in the general office Hot Rolled Sales Division.

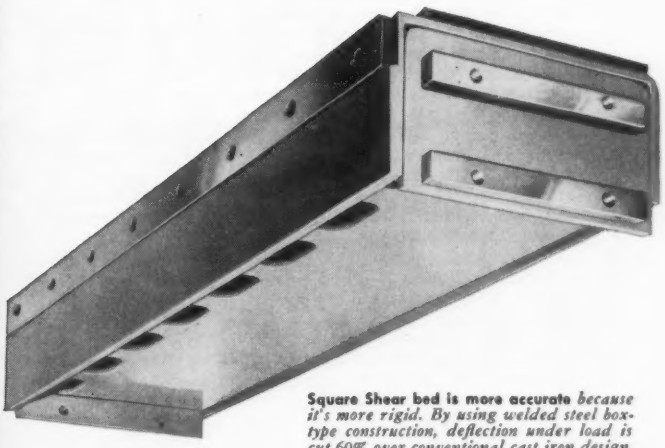
(*Continued on page* 258)

When steel is 3 times stronger than cast iron . . .

Has two and one-half times the rigidity...

Yet costs a third as much per pound . . .

WHY aren't more of your products designed for welded steel



Square Shear bed is more accurate *because it's more rigid. By using welded steel box-type construction, deflection under load is cut 60% over conventional cast iron design. Cost of construction is 28% lower than if made from castings. Photo courtesy Famco Machine Company, Kenosha, Wisconsin. View is from underside to show design details.*

HOW TO DESIGN HIGHER ACCURACY

. . . in precision machinery

THE photo shows how key components for modern machine tools are made even more accurate while reducing costs of manufacture.

With steel designs less material is needed, because of steel's greater strength, high rigidity. Using welding, the steel materials can be placed where they do the most good.

Have Lincoln Electric show you how you can incorporate these advantages in your designs now. Write . . .

THE LINCOLN ELECTRIC COMPANY

Dept. 1212, Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

For more information fill in page number on Inquiry Card, on page 229

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., has formed a new division for the fabrication and sale of steel springs. Known as the Spring Division, the new organization combines all previously existing spring fabrication and sales activities, including the Spring Works, Pittsburgh, and the company's Railway and Spring Sales Division. WILLIAM KREPPS continues as manager of sales of the Railway Spring Department. At the same time, THOMAS T. CROWLEY was named general manager of the new division. He was formerly staff assistant to W. H. WIEWEL, senior vice-president.

ROBERT S. ROBINSON has been named administrative assistant to the vice-president in charge of sales for Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. FRED W. KIESHAUER, who has served the company as an electrical sales engineer, was named product manager—magnetic laminations. JOSEPH A. KENNEDY was named to fill the newly created position of administrative staff assistant—sales division.

ALUMINUM COMPANY OF AMERICA has announced the election of five new vice-presidents. They are H. E. BAKKEN, manager of the Refining Division; J. P. HAIGHT, chief engineer; LAWRENCE LITCHFIELD, JR., general manager of the Mining Division; R. T. WHITZEL, general production manager; and EDWARD B. WILBER, treasurer. Each has been connected with Alcoa for more than thirty years.

HENRY M. MCADOO, JR., formerly plant manager of Nice Ball Bearing Co., Philadelphia, Pa., will become vice-president of manufacturing, following the retirement of J. E. MULLEN. JOHN J. LARKIN will become plant manager and THOMAS E. SPENCE will become chief engineer.

ROGER M. MCCRAY has been named product sales manager, Kennametal, Inc., Latrobe, Pa. Mr. McCray had been a sales representative in the Buffalo area since 1952, prior to which he was associated with the Corry-Jamestown Corporation as product engineer and the Elliott Co., Ridgway, Pa., as supervisor of methods and tooling. ROBERT N. ESLYN was named manager of sales planning. He has been associated with the company since 1950.

MARQUIS P. ORR has been appointed assistant manager of Roll Sales for E. W. Bliss Co.'s Mackintosh-Hemphill Division, Pittsburgh, Pa.

Coming Events

JUNE 11-15—Seventh National Plastics Exposition sponsored by the SOCIETY OF THE PLASTICS INDUSTRY, INC., to be held at the New York City Coliseum. Further information can be obtained from the exposition managers, Clapp & Poliak, Inc., 341 Madison Ave., New York City.

SEPTEMBER 17-21—Eleventh International Instrument-Automation Conference and Exhibit sponsored by INSTRUMENT SOCIETY OF AMERICA to be held at the New York City Coliseum. The society, which has its headquarters in Pittsburgh, Pa., has opened temporary offices at 250 W. 57th St. in New York City, from which it will direct the conference and exhibit.

SEPTEMBER 25-28—Iron and Steel Exposition to be held in the Cleveland Public Auditorium, Cleveland, Ohio.

SEPTEMBER 27-29—Thirty-third annual meeting and national supervisory development conference of the National Management Association to be held at the Sheraton-Jefferson Hotel in St. Louis, Mo.

Chambersburg Opens New Foundry

ADVANCED molding methods embodying cement-bonded sand are featured in the newly opened foundry of the Chambersburg Engineering Co., Chambersburg, Pa. The foundry produces gray-iron, alloy-iron, and ductile-iron castings for the company's own hammers, presses, and other equipment, and for the heavy-job field. Castings range in weight from 1000 to 150,000 pounds; 80 per cent of the tonnage is in castings heavier than 10,000 pounds. The facility incorporates the latest in mechanical handling equipment and flow technique, yet retains a high degree of flexibility.

Since use of cement-bonded sand is extensive in the foundry, it has been designed accordingly. Storage and distribution of the basic constituents of molding materials have been carefully worked out. Incoming cement dropped from the hopper of a railroad car is elevated and discharged into a 600-barrel capacity storage tank. When cement is required, a screw conveyor carries it from the storage tank to a weigh hopper at the mixer. Sand drops from the railroad car to a pit, is fed to an elevator, and then onto a belt conveyor to storage near the mixer.

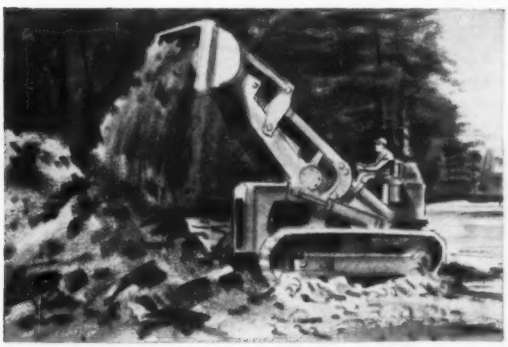
Both floor and pit molding are employed. Two molding pits, each 120 feet long and 20 feet wide, are available. The pits are separated and surrounded by concrete aprons permitting full use of electric trucks in delivering sand and cores. A roll-over draw machine conserves many molding hours. It can handle any mold or core up to 2000 pounds, and has a maximum draw of 26 inches. Compacting of the cement-bonded sand is done on a jolt machine.

A single cupola, having a melting capacity of 40,000 pounds, serves the needs of the foundry. The charging unit consists of an iron-loading platform, coke and stone hopper, bucket transfer car, and monorail type cupola charger. A yard crane teams up with the unit at the iron-loading platform. All other functions are performed by one man stationed in a pulpit.

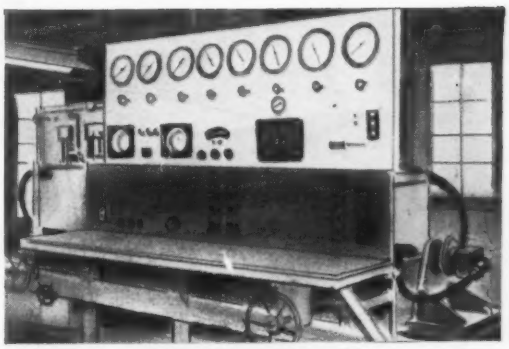
A unique feature of the cupola is the opening to the outside of the bottom drop doors. Thus, when pouring is completed, material from the charge can be cooled and reclaimed without interrupting activity within the foundry.

Over-all view of Chambersburg Engineering Co.'s new foundry.

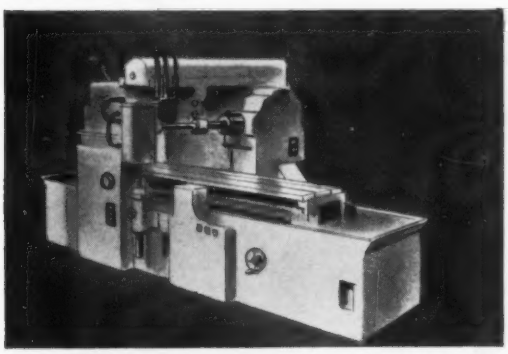
How hydraulic systems are simplified with 2000 psi vane pumps



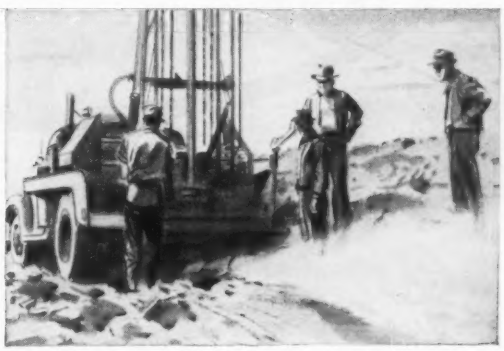
Lower weight on mobile equipment with smaller size lines, smaller controls.



Lower cost for test stands which require pressures up to 2000 psi.



Less space to pack more power with smaller size cylinders and valves on hydraulic machines.



Higher torque, higher horsepower per GPM – continuously on drilling equipment.

Exclusive balanced vane cuts wear, increases volumetric efficiency, reduces pulsations.

Vane-Type DENISON hydraulic, single stage pump/motor

INDUSTRY'S STANDARD FOR CONTINUOUS 2000 PSI SERVICE

Many types of hydraulic circuits are made simpler with the 2000 psi system using the Denison vane pump. Less space is needed, weight of pumps and controls is lower. Line loss inefficiency is greatly reduced because of the lower volumes required with a 2000 psi circuit.

As a pump, this Denison unit has high volume output at 2000 psi continuous delivery. As a motor, it delivers a high stalled torque . . . up to 257 inch-pounds per 1000 psi.

Write for Bulletin P-5-A for complete specifications on 4 sizes available for delivery up to 77 gpm as a pump and 1 to 103 hp as a motor.

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

THE DENISON ENGINEERING COMPANY

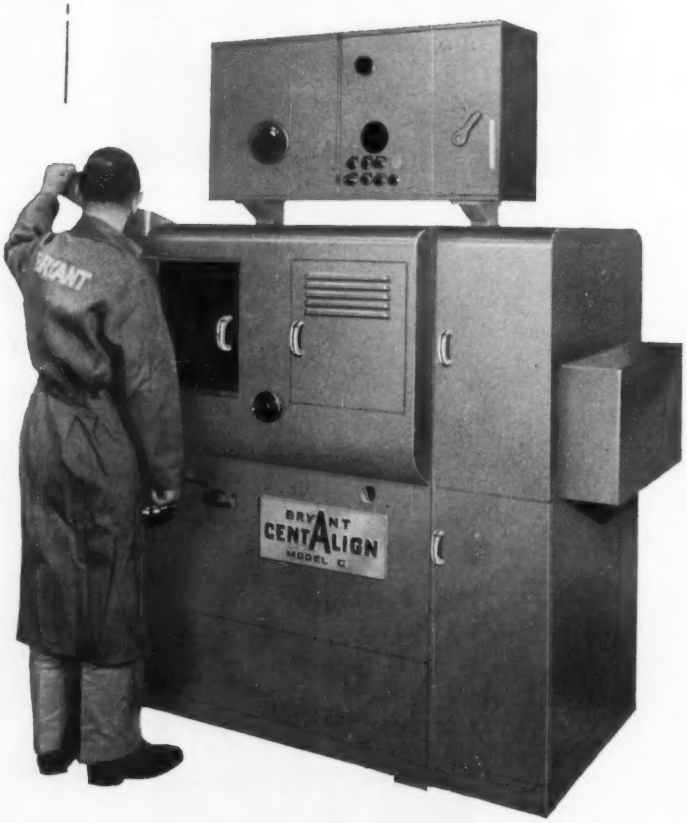
1244 Dublin Road • Columbus 16, Ohio

A Subsidiary of American Brake Shoe Co.

For more information fill in page number on Inquiry Card, on page 229

completely

BRYANT CENTALIGN



new in concept and design...

The Bryant "Centalign" Automatic Internal Grinder

Here is the machine you've asked for! The Bryant Centalign is specifically designed for the higher-production, lower-cost internal grinding of bearing raceways and taper bores, and for similar operations. It embodies the latest developments in shoe centerless grinding, and is adapted to automated lines. Ask for a demonstration.

BRYANT Chucking Grinder Co.

20 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers

For more information fill in page number on Inquiry Card, on page 229

New Dimensional Standards Established for Gage Blocks

First major improvement in gage block accuracies in 40 years meet realities of today's precision tolerances . . . overcomes inadequacies of finest blocks previously available

By RAY GIERLICH, Gage Division The DoAll Company, Des Plaines, Ill.

Here is What Has Been Done

- New laboratory gage block Grade AAA established with accuracy of *plus or minus one-millionth inch per inch of length.*
- Grade AA blocks (±.000002″) reduced in price as much as 70%, permitting wide usage for routine inspection work.
- New accuracy of plus .000004″, minus .000002″ established for Grade A blocks, with prices reduced to those formerly charged for Grade B. (National Bureau of Standards tolerance for Grade A blocks is ±.000004″ per inch. The new tolerance of two-millionths (.000002″) on the minus side affords a more accurate block and provides two-millionths cushion for wear.)
- Grade B sets (±.000008″) discontinued on the basis of their inadequacy for close tolerance measurement.
- New optical surface finish (guaranteed 0 to 0.09 RMS microinches) established for all blocks, providing superior accuracy and wear life.
- Every block is accompanied by a Certified Inspection Report stating deviation from nominal size.
- "A" grade blocks for the price of "B" grade blocks.

COMPLETELY NEW standards for gage blocks have been established by The DoALL Company after a comprehensive appraisal of modern measurement needs. They represent the first basic improvement in gage block accuracies since World War I, when .001″ was a high degree of precision.

Consider .0001″, a common tolerance today. The checking gage must be accurate to .00001″—equal to or better than the accuracy of many gage blocks in common use! For example, a new one-inch gage block is actually acceptable as "B" Grade if accurate to ±.000011″ including observational error. A two-inch block could have a permissible error amounting to 20% of the tenth (.0001″) tolerance. The error in a stack of such blocks would be prohibitive.

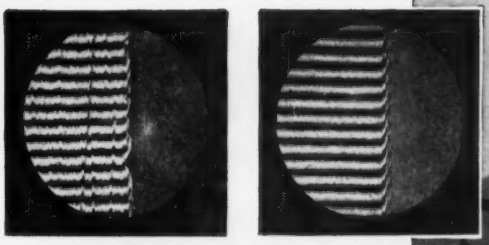
When tolerances of 75, 50 and even 25 millionths are specified, the need for better gages is instantly apparent.

As summarized at the left, DoALL has discontinued manufacture of Grade B blocks and has standardized on the grades listed in the following table.

New Standards for DoALL Gage Blocks

Grade	Tolerance per Inch of Length	Flatness	Parallelism	Surface Finish Microinches RMS
"AAA"	+.000001 −.000001	.000001	.000001	0.09
"AA"	+.000002 −.000002	.000002	.000002	0.09
"A"	+.000004 −.000002	.000004	.000004	0.09

Left—New DoALL Gage Block Sets are available in AAA, AA and A grades in 20 individual square block sets and 22 rectangular block sets ranging in sizes from 5 to 121 pieces. This includes two rectangular sets in the metric system. New plastic cases are compact, easy to clean and exceptionally durable and attractive. Wear blocks are available in sets in .050″ and .100″ sizes. A complete line of accessories makes possible assembly of fixed and indicating gages for every conceivable requirement.



Micro-interferograms of Block Edges

Above Right—DoALL Block Edges are "burr-proofed"* *after* final lapping by blending the gaging surfaces into a parabolic corner break that leaves no trace of a sharp edge. This exclusive process eliminates formation of edge burrs that cause wear and destroy accuracy.

Above Left—Sharp, ragged edge typical of blocks on which a corner radius is ground *before* final lapping. In use, damaging edge burrs are commonly formed.

Right—The author inspects blocks for dimensional accuracy with Zeiss Opton Interferometer in DoALL air-conditioned Gage Laboratory.

To provide infinitesimally accurate gaging, all blocks are now accompanied by a Certified Inspection Report stating deviation from nominal size.

Optical Surface Finish

Precise calibration of DoALL Gage Blocks to these new demanding standards would be impossible without another new achievement in gage block manufacture—optical surface finish of 0 to 0.09 RMS. For comparison, a gage block with a 1.0 RMS finish cannot be measured accurately to closer than two-millionths of an inch. The new finish also eliminates the severe, wear-producing abrading action encountered when rougher blocks are wrung together, thereby greatly extending the useful life of the blocks.

New Fractional and Tenth Blocks

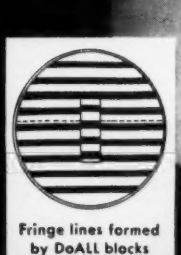
To further meet modern measurement requirements, three DoALL block sets have been enlarged to increase their versatility and speed gaging. The previous 118 piece set has been increased to 121 pieces by addition of 5/64", 7/64" and 3/32" blocks. The former 83 piece set has been enlarged to 86 by addition of .100025", .100050" and .100075" blocks, while Set No. 37 now becomes Set No. 38 with the addition of a .100050" block for half tenth measurement.

Gage Maintenance Manual

Handling and wear eventually take their toll of even the finest gage blocks. Therefore, periodic inspection and calibration is required. To help gage users save time and money, DoALL has developed the first practical guide to gage block inspection in the user's own plant. Entitled "Shop Inspection and Calibration of Gage Blocks", it describes the equipment and methods required for simple inspection for flatness and wear as well as for precision calibration of blocks. Copies are available upon request.

* * *

DoALL now offers industry the most accurately made and accurately calibrated gage blocks in the world. They provide finer, faster, lower-cost dimensional quality control than has ever before been available.



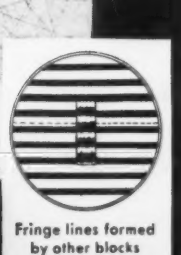
Fringe lines formed by DoALL blocks

Magnified Finishes

An ordinary microscope reveals differences in gage block finish.

Left—DoALL Block finish—guaranteed 0 to 0.09 RMS microinches. This block can be accurately calibrated by interferometry to tenths of a millionth of an inch because fringe lines are sharply defined. This fringe pattern can be seen simply by using an optical flat and monolight.

Right—Finish typical of many blocks in use today. This block cannot possibly be calibrated to tenths of a millionth because fringe lines are fuzzy and difficult to interpret.



Fringe lines formed by other blocks

FOR COMPLETE INFORMATION—

Call your local DoALL Service Store or write The DoALL Company, Des Plaines, Illinois.

LITERATURE FREE ON REQUEST—

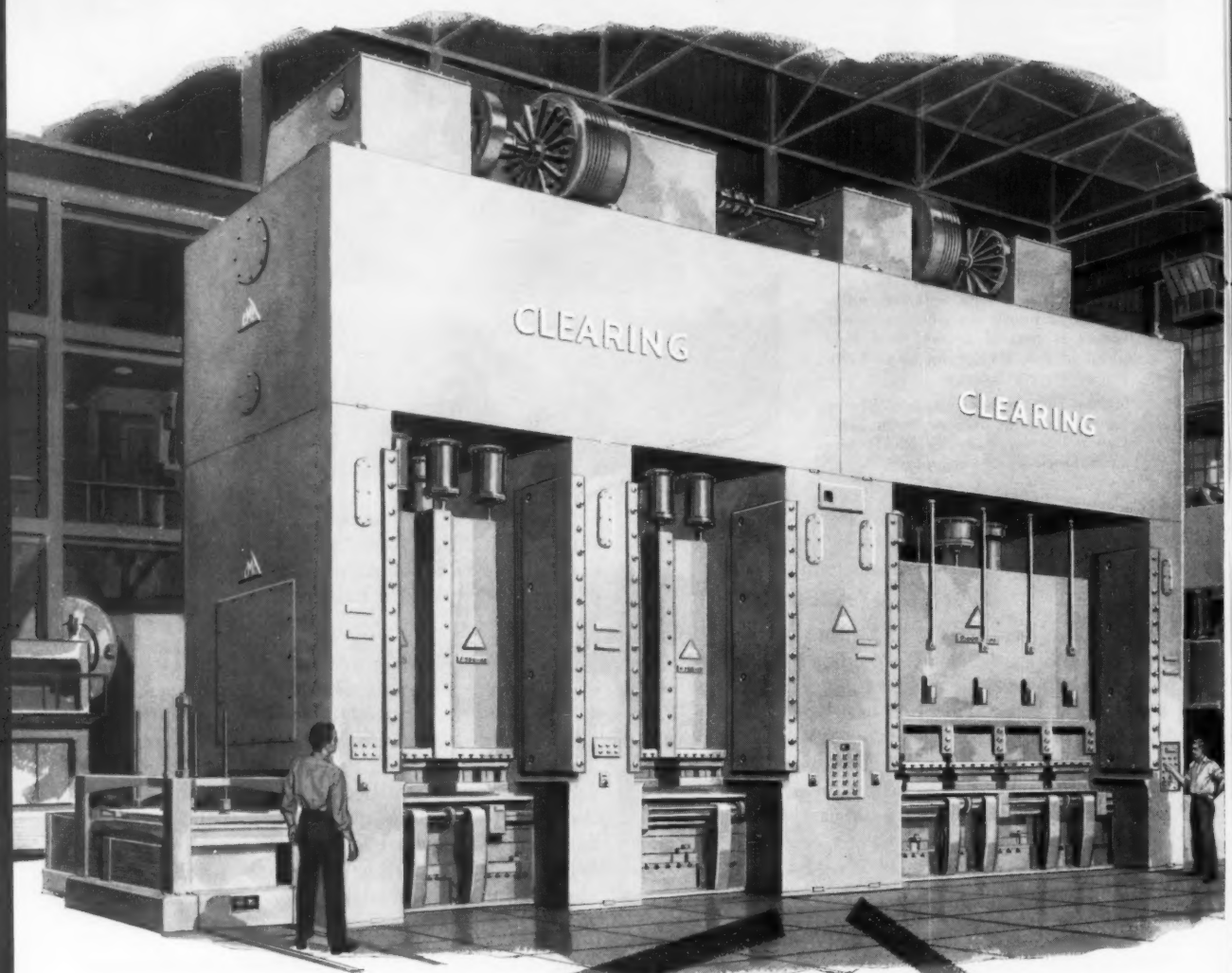
Call or write for a copy of the new DoALL Gage Block Catalog, listing all sets and accessories.

DoALL

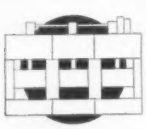
*U.S. Pat. No. 2,588,227

GB-16 rev.

CLEARING announces



Here's a veritable monster of a press (58 feet from end to end) that can never become a white elephant. It is built on the new Clearing MODULAR principle. As your requirements for stamping stations change, you modify the very structure of the press to suit the changed conditions.



MODULAR CONSTRUCTION

Two Drives

Two Beds

Two Crowns

Common Uprights
(Serve both crowns and beds)

SPLIT SLIDES

make instant die changes possible

MULTIPLE SLIDES

provide for differential loading

Transflex Feed Mechanism for automatic feeding—hands-off production

SUB-SLIDES

for individual die adjustment and die changes

MODULAR Presses

the TRANSFLEX equipment you can modify for major production changes

Modular press construction is a Clearing innovation that makes it entirely practical to automate the production of large scale parts without fear that future changes in models will render the press equipment obsolescent. The illustration at left shows a Transflex press designed for the General Electric Company to produce two similar parts alternately—without requiring an actual die change.

In order to obtain the most ideal production set up, a number of Transflex principles were applied . . . multiple slides, split slides, the versatile Transflex feed mechanism . . . and a giant press 58 feet in length began to take shape. By turning to modular construction a complex press of this size became practical. Two crowns are used with two separate drives mechanically interlocked. There are five slides, four uprights, and two beds. All of these parts add up to one automatic machine designed for today's type of production. However, if future model changes radically alter the number of operations required or the tonnage characteristics of the series, the investment in automation equipment will not have become obsolete. Modular frame elements can be added to or subtracted from the structure and the versatile transflex feed mechanism can be lengthened or shortened to recreate an automatic press which will meet tomorrow's production needs.

The Modular Principle

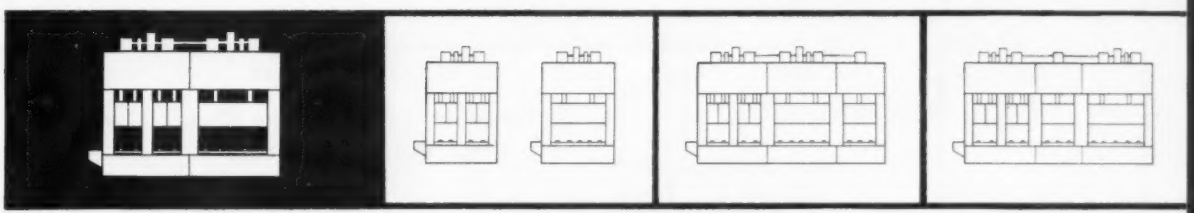
Here is how Clearing modular construction overcomes the historic drawback which heretofore would have made equipment of this nature impractical.

1956 A schematic drawing of the press as it was designed for the General Electric Company to produce washing machine and dryer covers in a dual tooling set up.

195? As requirements change the modular press can be converted to two separate presses, or . . .

additional modular units may be added to one end of the machine to increase the number of available stations, or . . .

additional modular units may be placed in the center to alter the sequence of tonnage capacities, etc.



WRITE FOR DESCRIPTIVE LITERATURE TODAY.

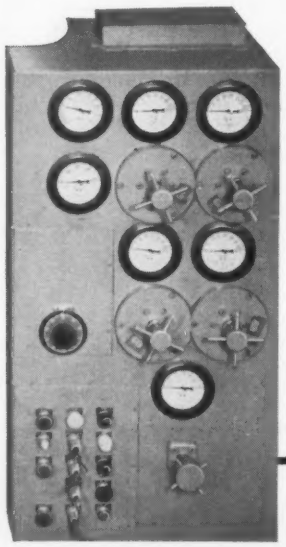
CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION • *Division of U. S. INDUSTRIES, INC.*

6499 W. 65th Street, Chicago 38, Illinois • Hamilton Plant, Hamilton, Ohio

Farquhar... the first triple-acting press with electric magnetic controls...

EVERY ADJUSTMENT of speed, timing and pressure is made by the operator on this Control Panel without leaving his operating station. It is no longer necessary for him to climb to the top of the press for this purpose.



...the only press that can do so many things so well

THIS hydraulic press revolutionizes the high speed production of draw-formed parts. We believe that it has rendered obsolete every double-acting and triple-acting press now in service. These are challenging statements... *but read the facts.*

A. B. Farquhar Division, The Oliver Corporation
Press Department, York 43, Pennsylvania

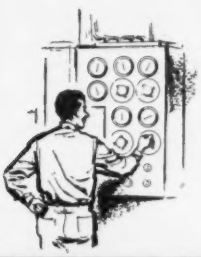
OLIVER

Farquhar **PRESSES**

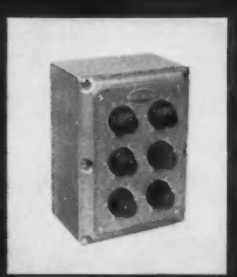
DRAWING • FORMING • FORGING • STRAIGHTENING • BENDING

For more information fill in page number on Inquiry Card, on page 229

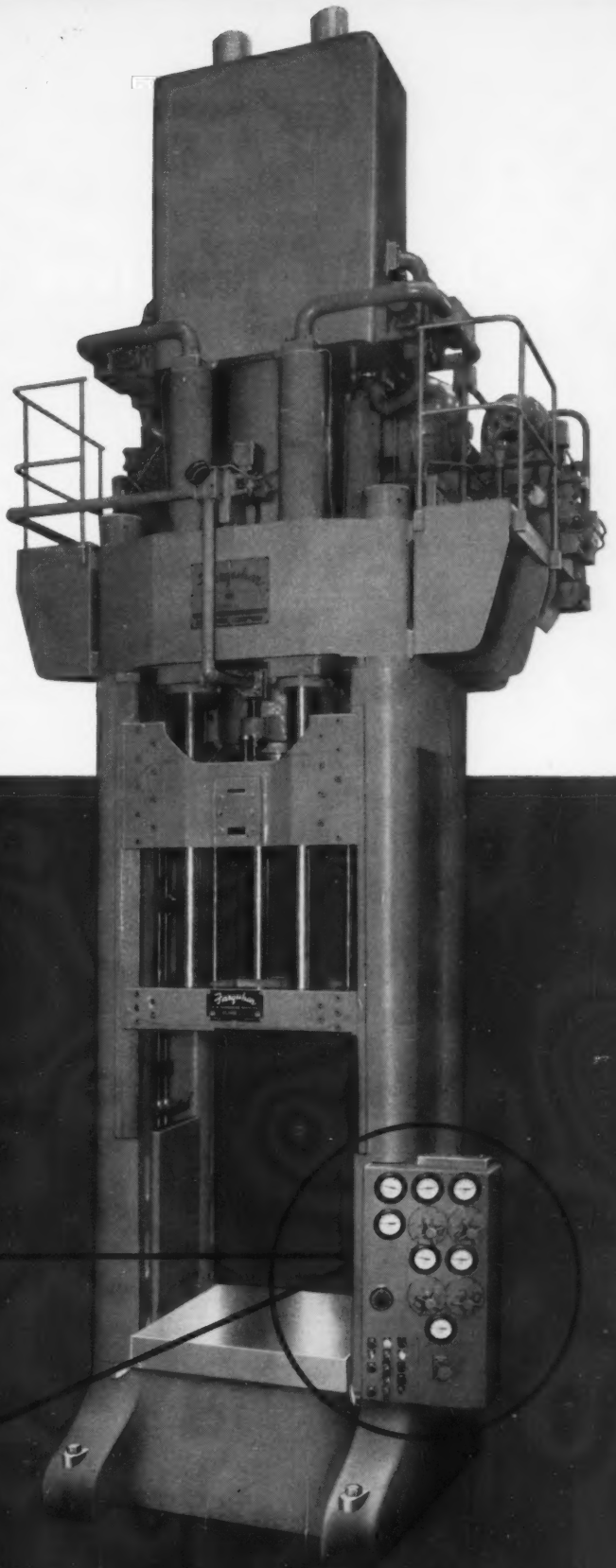
- **Unlimited speed changes** now possible at any point in the cycle. This means, for example, that the ram can approach the draw at maximum speed, slow down as it enters the draw, change speed in the middle of the draw, strip slowly and return to up position at maximum speed.
- **Draw-forming of difficult materials** is thereby greatly simplified and improved. The exact speed can be selected which is best suited to the characteristics of the material at any point in the stroke.
- **Expensive dies** can be given added protection by "gentle" treatment at point of contact and withdrawal.
- **Cycle time is greatly reduced,** because maximum speeds can be attained at every desired point in the cycle.
- **No expensive cams** with time-consuming adjustments are needed to obtain these results. All speed changes are made by dial settings on the control panel.



- **4-point adjustment of blank holder pressure** is made by operator without leaving operating station, an important device in the draw-forming of eccentric shapes. This has been a feature of Farquhar Double-Acting Presses in the past. It is an important feature of the new Farquhar Double and Triple-Acting Presses, too.
- **Best of all,** with these additional advantages, the Farquhar Double and Triple-Acting Presses are competitively priced!
- **For a more complete description** of these new Farquhar Presses with electric magnetic controls, write for Bulletin A-200. Please use your company stationery. A. B. Farquhar Division, The Oliver Corporation.

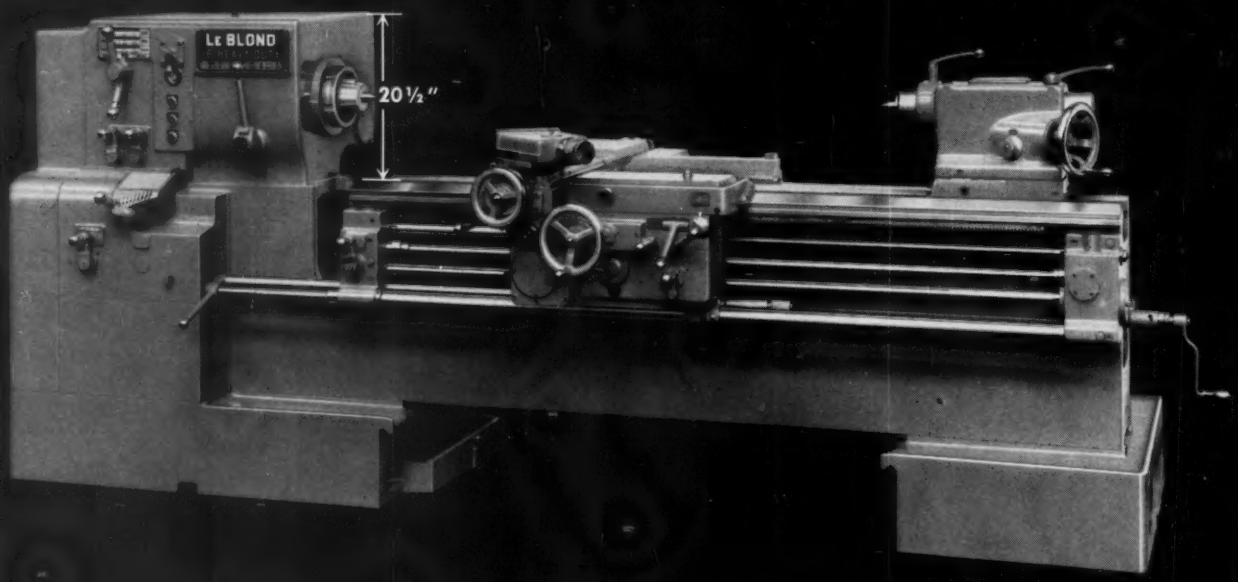


Speeds are pre-set by these radio-type dials which can be located within the main control panel or in a remote position.

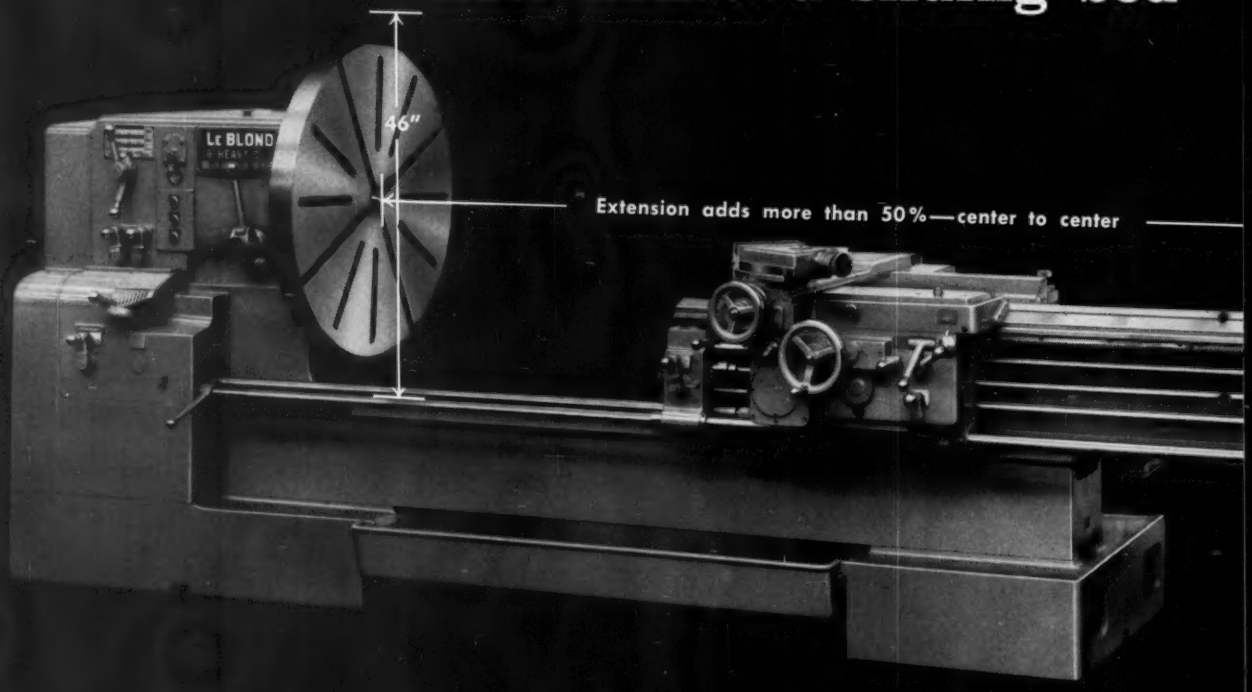


FORCING • ASSEMBLING • EXTRUDING • AND OTHER OPERATIONS

the lathe that gives versatile a new

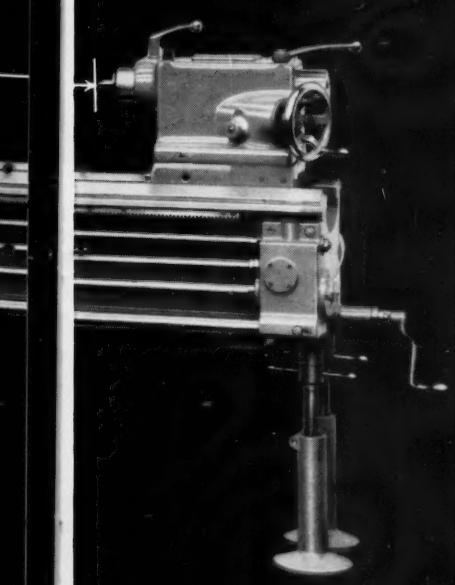


new LeBlond sliding bed



meaning!

gap lathe



Here's a lathe that is fundamentally different. It has a special bed that *slides* open to form a gap—gives you approximately *twice* the normal swing size. Sliding the bed also gives greater bed length, more than 50% greater distance between centers. And, with bed closed it functions as a regular engine lathe.

So, what we mean by a *versatile* lathe is one that actually changes shape to suit your odd-shaped parts. It handles all the usual work, plus a wide variety of large diameter jobs, extra long parts, and combinations of the two. "Swing size" as such is no longer a limitation. For example, here are some of the unusual capacities you can handle on the 16" LeBlond Sliding Bed Gap Lathe:

Face 38" diameters in one cut
Face 45" diameters in two cuts
Turn lengths more than 50% greater than normal center distance
With extension rest (optional): turn 27½" diameter, 13¼" length
With Full-Swing turning attachment (optional):
turn 45" diameter almost full length of gap

Other important features of the new LeBlond 16"/38" SBG Lathe include new spindle bearing design for high-speed turning, combination gear-belt drive headstock, 18 geared speeds, 9 timing belt-driven speeds from 8 to 2000 rpm, spur gear design, four-way rapid traverse, one-piece apron, totally enclosed quick change box, hardened and ground steel bedways, thrust-lock tailstock.

If you have a variety of parts to turn—particularly the unpredictable extremes you encounter in maintenance and job shop work—the LeBlond SBG may well be the answer. An economical answer, too! SBG's come in 4 sizes: 16"/38", 25"/50", 32"/60" Heavy Duties and the 17"/28" Regal. Like all LeBlonds they are built in every engineering detail to give you long dependable service.

Whatever your turning needs, there's a lathe in LeBlond's complete line to do the job. 76 different models to choose from. Call your LeBlond Distributor or write today.

. . . cut with confidence

LeBLOND *of Cincinnati*

THE R. K. LEBLOND MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

World's largest builder of a complete line of lathes for more than 69 years

. . . a boost for screw machine output!

The Success of SpeedKut A . . . is an oft repeated story of increased output, better tool life and less downtime. For SpeedKut A is one of Stuart Oil Company's balanced, general purpose cutting oils specifically designed for high speed machining of free-machining screw stock and brass on single spindle and multiple spindle automatic screw machines, turret lathes, milling machines, and hobbing machines.

SpeedKut A is a product of Stuart's sulphochlorination processing that provides absolute uniformity and stability. Highly effective chemical additive materials are pre-balanced under strict laboratory supervision to instill SpeedKut A with the anti-weld and friction reducing characteristics necessary to the range of machining operations for which it is recommended.

When selecting a cutting fluid, factors to be considered are material being machined, material hardness, speeds, feeds, depth of cut and machine design. Cullman Wheel Company, Chicago, Ill., a leading sprocket manufacturer, took all these factors into consideration more than 10 years ago. They chose SpeedKut A then and still use it for their multi-spindle automatics to cut sprocket blanks from free machining bar stock and for hobbing the sprocket teeth.

Your operation may be another link in this success story of SpeedKut A . . . or perhaps the factors that must be considered indicate a different type of balanced cutting fluid. "The Man in the Barrel", your Stuart Representative, will help you take all of the factors into consideration. Consult him. You'll be happy you did.

Write for Stuart's Cutting and Grinding Fluid Selector and Dilut-O-Graph Folder. It's a quick guide to starting recommendations for any job. Your name and title on a company letterhead is all that's needed.

D. A. STUART OIL CO. LTD.
2739 S. Troy St., Chicago 23, Ill.

More than a "Coolant" is Needed

Stuart Oils

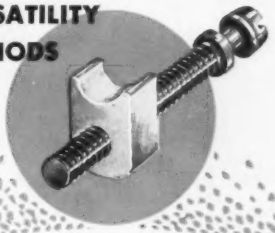
Time Tested Cutting Fluids and Lubricants

Plants in: Chicago, Detroit, Cleveland, Hartford, and Toronto, Ontario.

Branch Warehouses and Representatives in principal metal working centers in the United States, Canada and Europe.

Bodine CASE HISTORY NO. 42

HEADLIGHT ADJUSTING SCREW ASSEMBLY SPOTLIGHTS VERSATILITY OF BODINE METHODS



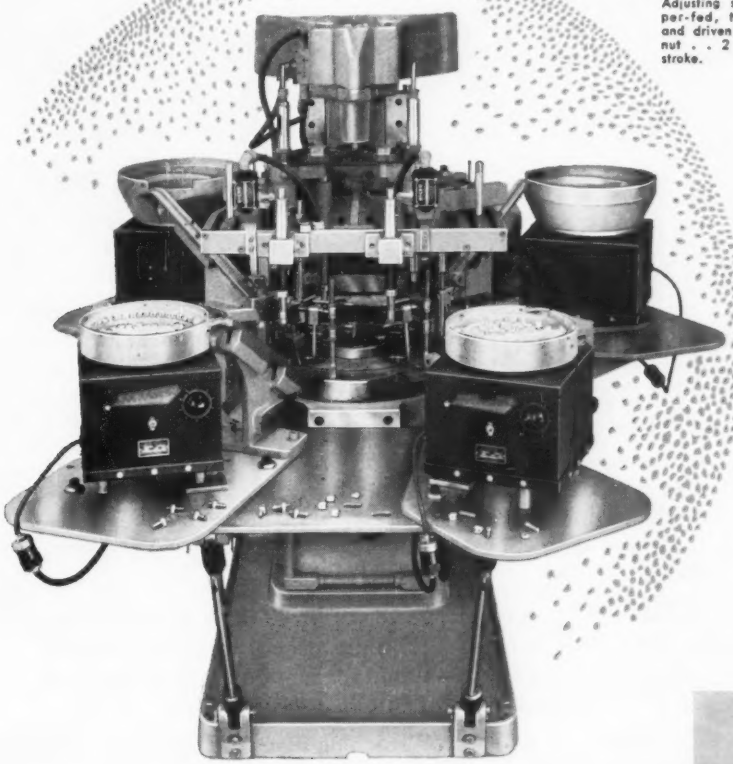
This is but one of many ways in which versatile, time-tested Bodine basic machines and units can be teamed to create high-speed, cost-cutting assembly units without resort to costly "specials."

Note especially the ease and convenience with which auxiliary equipment (in this case automatic hopper feeds) can be grouped around the Bodine "chassis." Note also the high production and close limits maintained on this day-in, day-out production line job for one of the world's largest automobile manufacturers.

PRODUCTION: 3,000 completed assemblies per 50-minute hour. Machine speed, 30 strokes per minute.

1 Unthreaded molded nylon nut hopper-fed and transferred to the dial fixture . . . 2 pieces per stroke.

2 Adjusting screws hopper-fed, transferred and driven into nylon nut . . 2 pieces per stroke.



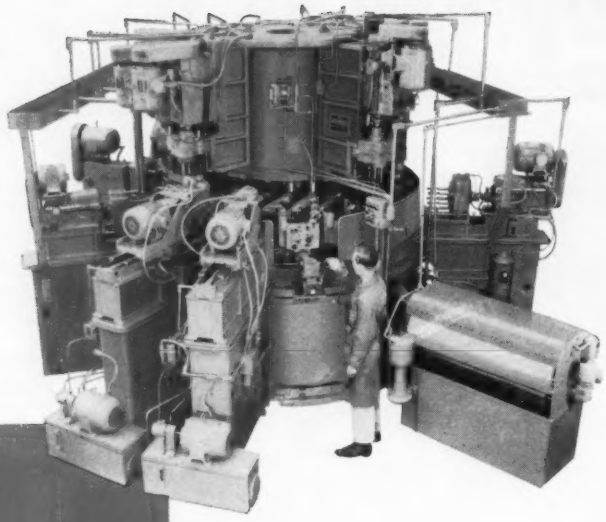
3 Auto eject completed assembly. Depth of screw driving held consistently within ½ turn in untapped nut.

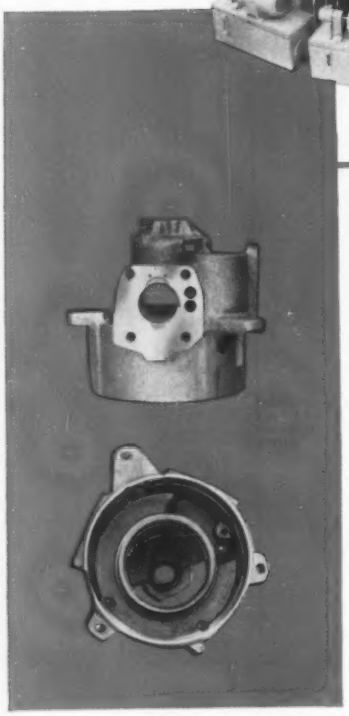
Write Dept. M-6

If high-speed, low-cost assembly is one of your problems . . . in metals, plastics, or a combination of both . . . with or without concurrent machine operations . . . check first with Bodine. The possibilities of our methods are practically unlimited.

THE Bodine CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

6BD55





18
STATIONS

47
OPERATIONS

120
PARTS/HOUR

THIS intricate production giant is also a triumph in metal-working flexibility. Designed for a leading appliance manufacturer, the MORRIS Model 334-S High Production Machine processes one-cylinder *or* two-cylinder housings at the rate of one every 30 seconds.

Yet there's no model change-over problem! The MORRIS completely automatic "special" machine uses a MORRIS basic center column machine equipped with an 84″ dia. table, an 18-station automatic hydraulic index, and MORRIS Unit-Type Machine Tools.

A total of 47 spindles, mounted on three 8-inch way type units, six No. 2 CAM-MATIC Drill Units and eight AIR-OIL-MATIC Drill Units, are used to mill, drill, counterbore, spot face, bore, ream and tap housings.

The result . . . a "special" machine at a fraction of the usual special machine cost . . . accurate, flexible, fast!

Investigate the production-boosting and cost-saving advantages of MORRIS Unit-Type High Production Machine Tools.

WRITE TODAY for detailed literature, or outline your production problem for analysis by MORRIS engineers.

1..... LOAD 1 PART

2H..... MILL 1 SURFACE

3H..... FINISH MILL 1 SURFACE

4V..... DRILL AND BURR 1 HOLE
DRILL AND COUNTERBORE 4 HOLES

5H..... DRILL 4 HOLES
V..... DRILL AND BURR 1 HOLE
DRILL 2 HOLES

6V..... BURR 2 HOLES
REAM 1 HOLE

7H..... SPOT FACE 3 PLACES
V..... DRILL AND BURR 1 HOLE
DRILL 1 HOLE
MILL .250 RADIUS

8V..... REAM 1 HOLE BURR 1 HOLE
BURR .250 MILLED RADIUS

9A..... MILL 1 SURFACE
H..... DRILL AND BURR 4 HOLES
REAM 1 HOLE

10 } ..... The angular operation at Station 9
11 } utilizes those two stations as well.

12V..... TAP 1 HOLE
A..... DRILL FOR REAMING

13V..... ROUGH BORE CYLINDER DIAMETER

14V..... SEMI-FINISH BORE AND CHAMFER CYLINDER DIAMETER

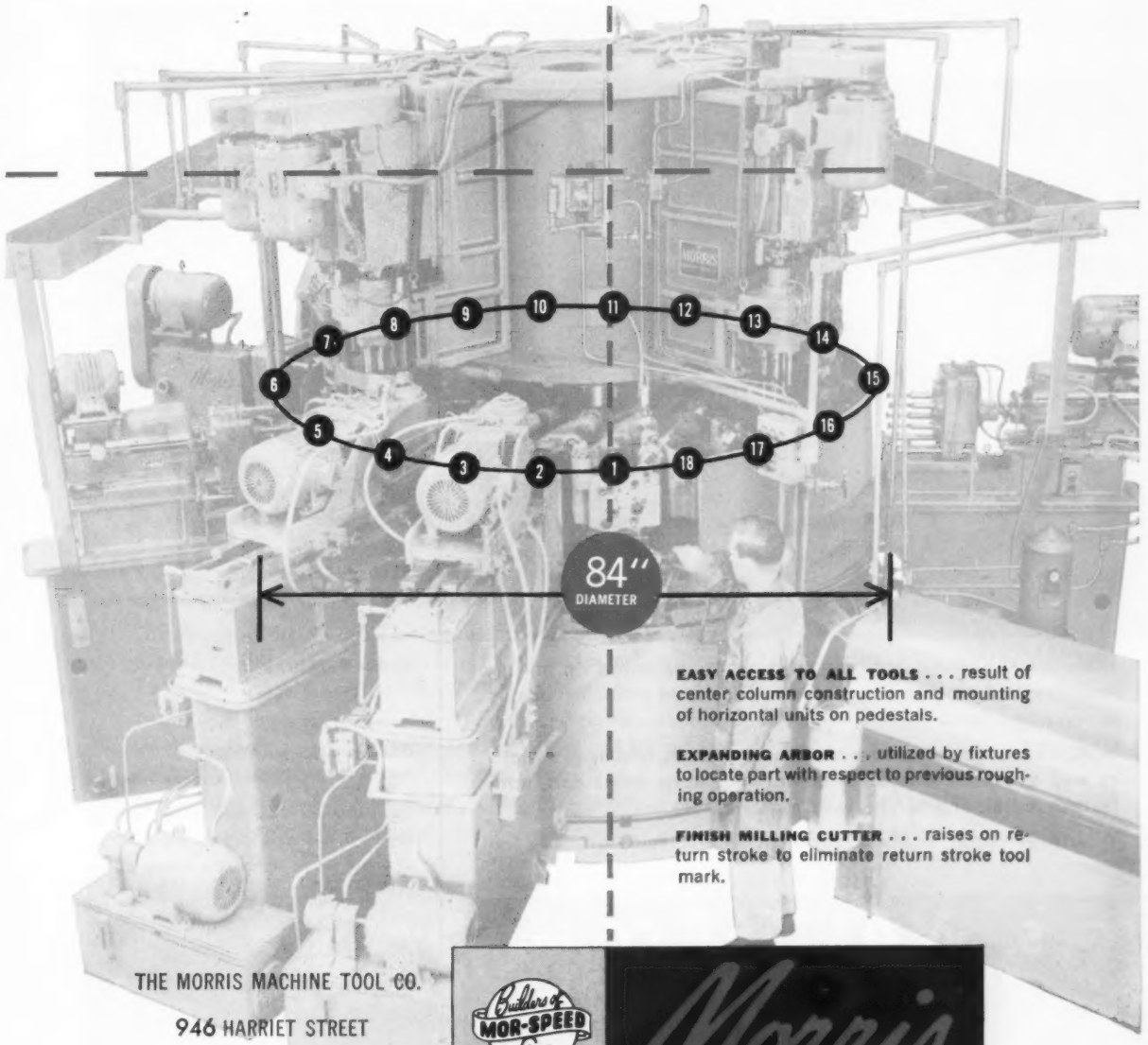
15H..... TAP 4 HOLES
V..... FINISH BORE CYLINDER DIAMETER

16V..... CHAMFER BOTTOM OF BORE WITH RECESSING TOOL

17V..... TAP 5 HOLES

18..... Station 18 is reserved for additional operations for future part changes.

Operations: H—Horizontal
V—Vertical
A—Angular



EASY ACCESS TO ALL TOOLS . . . result of center column construction and mounting of horizontal units on pedestals.

EXPANDING ARBOR . . . utilized by fixtures to locate part with respect to previous roughing operation.

FINISH MILLING CUTTER . . . raises on return stroke to eliminate return stroke tool mark.

THE MORRIS MACHINE TOOL CO.
946 HARRIET STREET
CINCINNATI 3, OHIO

Builders of MOR-SPEED Line

Morris

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES

See Discs, abrasive

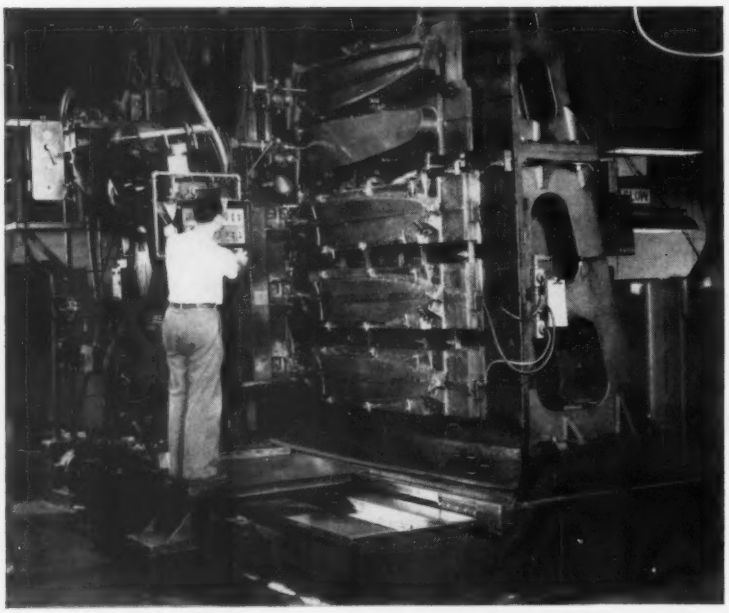
ABRASIVES, HONING

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.

Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

Walker Does it Again -



Three WALKER electro-magnetic chucks mounted on milling machine, making possible profile milling three propeller blades in one operation.

WALKER engineers and makes chucks for unusual applications as well as standard holding devices for irons and steels, non-ferrous metals and non-metallic materials.

Whatever your holding problem the originators of the magnetic chuck will solve it for you.

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

IN CANADA—UPTON BRADEEN & JAMES, LTD.

ACCUMULATORS, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Vickers Incorporated Division of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

AIR HOISTS—See Hoists, Air

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Non-Ferrous

American Brass Co., 25 Broadway, New York.
Bridgeport Brass Co., Bridgeport, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc

New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES

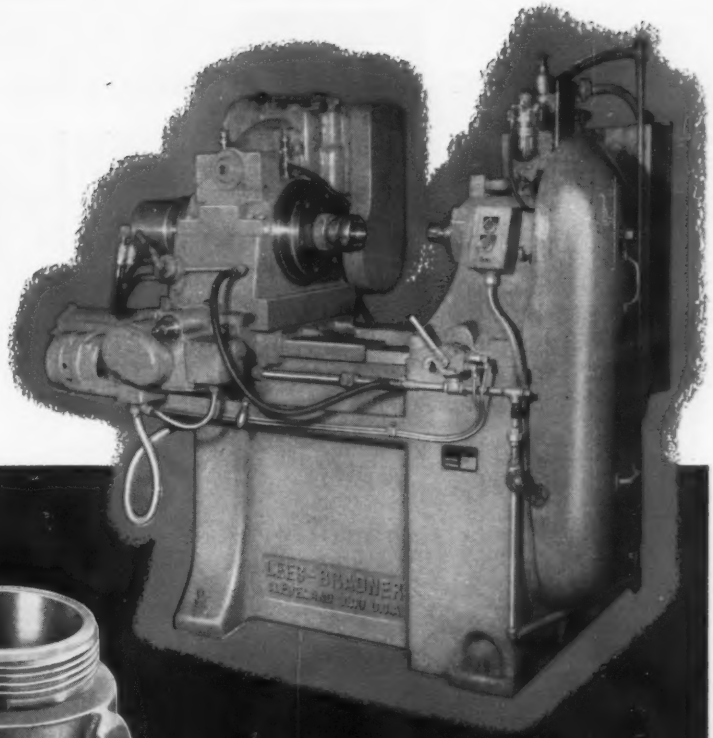
See Presses, Arbor

ARBORS AND MANDRELS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., Milwaukee, Wis.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Shenango-Penn Mold Co., Dover, Ohio.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page* 276)

It took this HIGH-SPEED Heavy-weight to lick this tough job!



The Lees-Bradner Special High Speed Thread Milling Machine

The Lees-Bradner Special Thread Milling Machine really shows its class when it works with brass!

The Akron Brass Manufacturing Company of Wooster, Ohio produces these threads, internal and external, each in 13 seconds with a 5000 RPM cutter spindle speed.

This is just one example of the many threading jobs that the modern, high speed, Special Thread Milling Machine can do better, faster and with unmatched precision.

Write The Lees-Bradner Company for full information on this remarkably versatile machine.

DETAILS ON THIS JOB

Hob Spindle Speed, 5000 R.P.M.
(Using a high speed cutter spindle)

Thread Pitch (internal and external)	7½
Thread Diameter	3"
Length of Thread	¾"
Threading Time	13 seconds
Material	Brass
Weight of Parts	
Internal thread	1 lb. 13 oz.
External thread	2 lb. 10 oz.

the LEES-BRADNER Company

CLEVELAND 11, OHIO • U.S.A.

in DRILLS for FERROUS METALS

To boost your production—have fewer resharpenings—reduce drill breakage—lower costs—Whitman & Barnes manufactures a complete line of drills for ferrous metals. Each drill type is specifically designed to provide highest efficiency when drilling individual metals.

Over 100 years of research, experience and engineering have enabled W & B to provide better drill designs—"There's A Big Difference"—that difference means faster, better and more economical drilling for you. Call your W & B distributor for quality service and the best in drills.

Whitman & Barnes manufactures complete lines of standard drills, reamers, carbide tools, counterbores, countersinks and tool bits, also special tools to your specifications.

W&B *"Makers of Fine Tools Since 1848"*

WHITMAN & BARNES

40040 PLYMOUTH ROAD • PLYMOUTH, MICHIGAN

NEW YORK • CHICAGO • LOS ANGELES

BABBITT

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Illinois

BALLS

Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Shenango-Penn Mold Co., Dover, Ohio

BARS, Steel

Allegheny Ludlum Steel Corp., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BEARINGS, BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., Poughkeepsie, New York.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.

BEARINGS, Lineshaft

Fafnir Bearing Co., New Britain, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

(Continued on page 278)

RELIANCE DRIVES NEW MILLING MACHINE

This unique milling machine designed for milling big aircraft parts operates exactly like a huge arm. Its cutter swoops in and out at the touch of the joy stick control. The direction in which the stick is pushed is the direction of the head movement. The harder the push the faster the movement.

This unusual feed drive is made possible by a Reliance V★S Drive. Two 7½ hp. Variable Speed D-c. Motors, one each at shoulder and elbow, provide the flexible arm-like feed movements. The motors are controlled and directed by the joy stick.

The result is an extremely compact and versatile feed drive that gives eye-popping performance. Economical in original cost, these Reliance Drives will provide years of steady service with little maintenance.

If you are designing, building or buying machine tools, it will pay you to check the economies of Reliance Variable Speed Drives. A-1516

Write for Bulletin D-2311

RELIANCE V★S DRIVE ®

RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 36A, CLEVELAND 10, OHIO • CANADIAN DIVISION: WELLAND, ONTARIO
Sales Offices and Distributors in Principal Cities

"Magnamatic"

Shifts to Neutral at desired torque

reduces work spoilage

"Magnamatic" is the only "One-Shot" type of Controlled-Torque screwdriver-nutrunner that has proven itself in two years of heavy-duty "on the line" service in industry! Typical of hundreds of satisfied users is a large mid-western company, whose 40 "Magnamatic" Screwdrivers-Nutrunners have:

- **Reduced bit breakage to 1/20th**
- **Reduced production delays**
- **Reduced rejects caused by damaged work surfaces**
- **Reduced noise levels from 83 to 68 db.**
- **Minimized screwdriver maintenance**

The instant a "Magnamatic" air-driven screwdriver-nutrunner reaches desired torque its automatic "One-Shot" clutch shifts to neutral. There's no harmful hammering, impacting or ratcheting to run fasteners past proper tightness and to damage surfaces, break bits, burr screw heads, strip threads or shear fasteners. And "Magnamatic" is *Quiet* . . . clutch buzz is eliminated and exhaust noise is muffled by a new principle of baffling. For complete details call your Chicago Pneumatic sales office or mail coupon.
Chicago Pneumatic Tool Company,
8 East 44th Street, New York 17, N. Y.

CAPACITIES:
#4 screws to ⅜" bolts.
Reversible and non-reversible types.

Chicago Pneumatic Tool Company, Dept. M-31
8 East 44th Street, New York 17, N. Y.

☐ Please send me FREE booklet SP-3165 "Magnamatic" Case Histories

☐ Please send me "Magnamatic" Bulletin SP-3126

☐ Have representative call

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Chicago Pneumatic

Pneumatic Tools • Air Compressors • Electric Tools • Diesel Engines
Rock Drills • Hydraulic Tools • Vacuum Pumps • Aviation Accessories

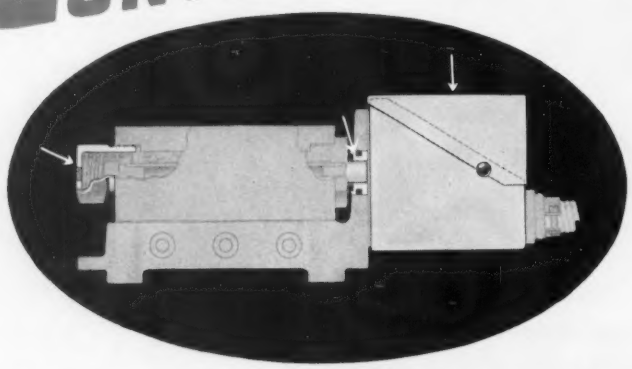
For more information fill in page number on Inquiry Card, on page 229

SELECT

Quick-As-Wink®

AIR AND HYDRAULIC

CONTROL VALVES



New Dust-Tight Construction

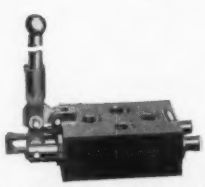
for SOLENOID VALVES

protects all operating parts from Dust and Grit

● Now you can get even greater value in Quick-As-Wink Solenoid Valves — *at no increase in price.* They've been dust proofed. A sintered bronze filter in the breather hole permits air to pass through in either direction, but prevents the entrance of dirt. A sleeve with two "O" rings assures dust-free operation where the solenoid armature contacts the valve plunger. The overlapping cover for the solenoid fits tightly but can be removed easily. It protects the solenoid even from the dust and grit blown around during "cleaning up" operations; provides ample space in which to connect the control wiring to the solenoid leads; and permits the splice to be tucked away inside the cover, not pulled back into the piping. Write for full details — *today!*

Ask us also about . . .

DIAPHRAGM OPERATED "O-TYPE" VALVE, can be actuated with instrument air as low as 12 to 15 psi.

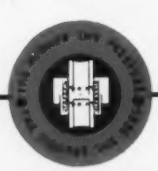


LEVER OPERATED HYDRAULIC VALVE suited for water or hydraulic oils up to 5000 psi. 2-way, 3-way and 4-way actions.

Quick-As-Wink®

AIR AND HYDRAULIC

Control Valves



Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

Mfd. by C. B. HUNT & SON, INC., 1946 East Pershing St., Salem, Ohio

BEARINGS, Needle

Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Roller

Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Self Lubricating (Oilless)

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

BEARINGS, Tapered Roller

Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust

Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Shenango-Penn Mold Co., Dover, Ohio.
Timken Roller Bearing Co., Canton, Ohio.

BELT SHIFTERS

Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, Transmission

Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

BENCHES, Work, and Bench Legs

Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.

Consolidated Mch. Tool Corp., 656 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BENDING MACHINES, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Farquhar, A. B., Div. Oliver Corp., York, Pa.

BLAST CLEANING EQUIPMENT

Modern Ind., Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

(*Continued on page* 282)

Maytag switches to STANICOOL HD *Soluble Oil— makes two-way saving*

1 ***Cost of soluble oil reduced***

2 ***Soluble oil consumption cut two-thirds***

A 300 ton Verson press at the Maytag plant, Newton, Iowa, is used for piercing holes in the inner tubs of Maytag's fine automatic washers. Material used is 18 gauge enameling iron. Holes are pierced in six automatic cycles. A total of 936–3/16 inch holes and 6–19/32 inch holes are incised in each tub.

A check of manufacturing costs on the tubs disclosed that the cost of soluble oil per unit produced was too high. Standard Oil lubrication specialist J. I. Nelson, working with plant management suggested a switch to STANICOOL HD Soluble Oil. The switch was made and Maytag received the first part of its two-way saving: the cost of soluble oil per gallon was reduced. Then it was found that the same high quality product could be turned out, without loss of tool life, while spraying only every third tub. Formerly *each* tub was sprayed with soluble oil before punching. With STANICOOL HD, soluble oil consumption was reduced two thirds. And thus, Maytag received part two of its two-way saving.

Perhaps STANICOOL HD Soluble Oil can help you make similar savings. Find out. Call your nearby Standard Oil office in any of the Midwest or Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Dwight Norton (right) a Maytag plant foreman inspects automatic washer inner tub with Jesse I. Nelson, Standard Oil lubrication specialist. Jesse Nelson is well qualified to provide lubrication technical service. He has a B.S. degree in engineering from the University of Iowa and has completed the Standard Oil Sales Engineering School. Jesse has been helping customers with lubrication problems for more than three years. Customers find his experience and training pay off for *them*.

STANDARD

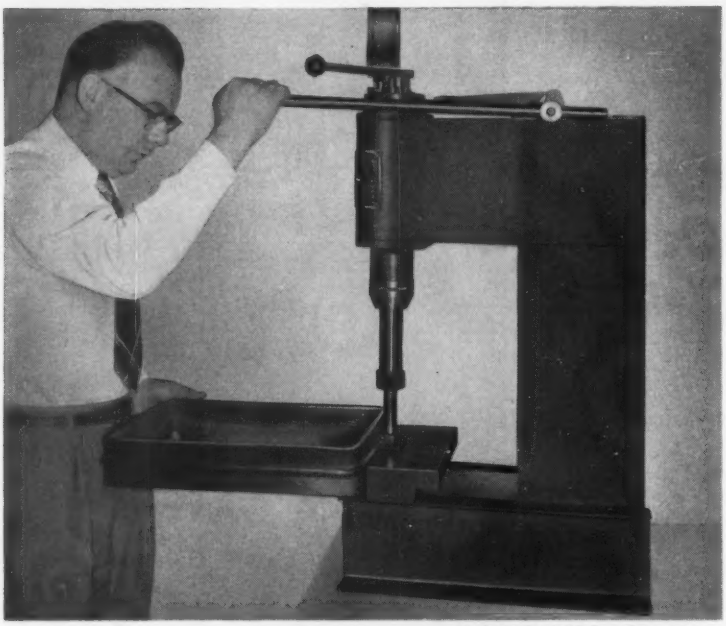
STANDARD OIL COMPANY
(Indiana)

Quick facts about

STANICOOL HD Soluble Oil

- **Emulsifies readily with all waters.**
- **Forms stable, uniform emulsion.**
- **Does not turn rancid.**
- **Non-injurious to men, machines and work.**
- **Economical. Meets work requirements with relatively low emulsion concentrations.**
- **Prevents rusting of work and machines.**
- **Gives better tool life.**
- **Doesn't form gum on machines.**

NEW K. R. WILSON HYDRAULIC BENCH ARBOR PRESS



Model 137-BH 10 Tons Capacity

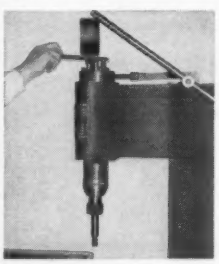
THE MOST ADVANCED . . . MOST FUNCTIONAL BENCH ARBOR PRESS AVAILABLE TODAY

Put this new, 10 tons capacity K. R. Wilson Bench Arbor Press into your shop and in just a few short days you'll rate it "indispensable." This compact, low cost press offers so many new advanced features that it outmodes all existing, comparable presses. It is so versatile that it will perform scores of operations, such as replacing bushings on foundry molding flasks, removing and replacing gears, bearings, pulleys, bushings, pins and inserts on motor shafts, renewing surface and size of die head shanks, as well as bending, straightening, marking and punching.

Only K. R. WILSON gives you all these money-saving, time-saving features

"FINGER TIP RAM CONTROL"

K. R. Wilson's patented, lever operated, release valve can be controlled with a flip of the finger. Just touch the lever to raise the ram off the work . . . release and the ram stops exactly where you want it to. You can control ram return to within a fraction of an inch. Rapid ram return means even more time saved.



SPECIFICATIONS SPELL "VERSATILITY" 6¾" hydraulic stroke, 12" maximum daylight opening, 8½" throat depth and 6¾" between base members.

SUPERIOR IN DESIGN & CONSTRUCTION Design features include built-in maximum stroke limit mechanism. Construction is sturdy, all-welded steel boxed column type.

COMPLETELY SELF-CONTAINED Hydraulic cylinder is completely self-contained. There are no connections to make or break . . . no leakage. Whole unit can be removed without draining oil.

STANDARD EQUIPMENT One pair matched V blocks, one slotted table plate and one pressure gauge included in low cost. Optional accessories available.

Get full details and complete specifications. Write for Bulletin No. 104.

HYDRAULICS DIVISION

K. R. WILSON, Inc.

Offices & Factories – 212 Main St., Arcade, N.Y., U.S.A.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BLUING LAYOUT
Dykem Co., 2303P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOOKS, Technical
Industrial Press, 93 Worth St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

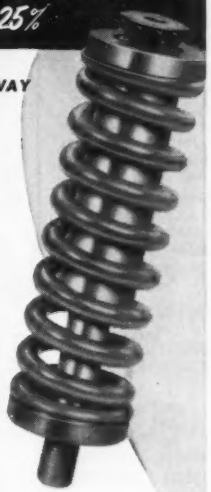
BORING AND DRILLING MACHINES
Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING AND TURNING MILLS, Vertical
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

(*Continued on page* 284)

WALES "Strippits"
can save up to 60% time,
BOOST PROFITS 25%

. . . stripping Metal from conventional Dies the WALES-WAY



● WALES STRIPPITS are sure tempered springs, held compressed by retainers. Uneven stripping pressure is eliminated completely, having constant pressure standard at all points and at all times and under all conditions.

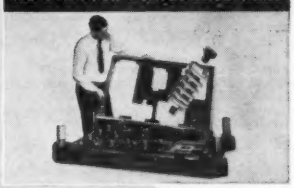
No more costly delays, removing dies from the press for repairs. With WALES STRIPPITS, dies never need be removed nor dismantled for any repairs. Stripper plates easily and quickly removed in the press. The plates may be half usual thickness or non-existent, as there is no pressure exerted until the WALES STRIPPITS go into action.

Save up to 60% man hours and material cost in die making. Installation is EASY. WALES STRIPPITS pay for themselves over and over in time saved on every job.

Our ENGINEERING SERVICE is for YOU!

We'll be happy to make an analysis of your production and give you suggestions as to how WALES STRIPPITS can supplement your present methods and INCREASE YOUR PROFITS. No obligation.

NO STRIPPER PLATES USED HERE



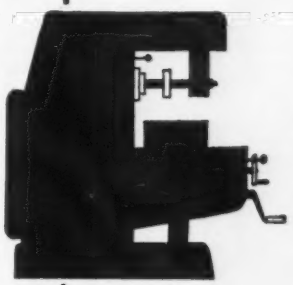
This picture shows work blanked by die, equipped with WALES STRIPPITS. Even STRIPPIT pressure releases work piece instantly.

Send for BULLETIN NO. 15E

Filled with pictures and examples of WALES STRIPPITS in use. Mailed to you without cost and by return mail.

WALES Strippit CORPORATION
"...the Wales-Way is the PLUS-PROFIT way"
345 PAYNE AVE. — North Tonawanda, N.Y.
WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.

production begins with



Columbus Die-Tool

No tools like the right tools! Columbus Die-Tool designs and builds tools, jigs, fixtures and special machinery to meet your most exacting requirements. RESULTS: operating cost that matches your budget; production that matches your schedule; product quality that matches the demands of your market.

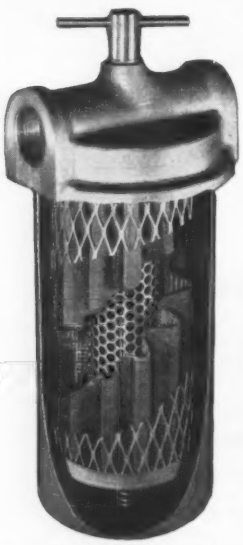
Contact Columbus Die-Tool & Machine Co. first—when you have a special machine problem. They are nationally known as expert designers and builders of special machinery and equipment . . . have been for over 50 years.

Columbus Die-Tool
AND MACHINE COMPANY
P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

Here's What Users Have to Say About MARVEL *Synclinal* FILTERS

SUMP TYPE (cutaway)



LINE TYPE (cutaway)

U. S. STEEL Co., Irvin Works Three-Stand Cold Reduction Mill—

"Marvel Synclinal Filters are a part of the mill's main hydraulic system which operates Coil Cradle as well as other hydraulic machines".

JONES & LAUGHLIN STEEL CORP., Aliquippa Works—"Marvel Synclinal Filters proved their effectiveness when one of the motors on the hydrostatic pipe testers broke down. A brass fitting was chewed up and jagged pieces of brass were carried into the oil stream. Any small piece of brass could also have caused a great deal of damage to the expensive equipment. However, when the unit was inspected, it was found that all metal particles had been filtered out by the Marvel Synclinal Filters and no damage had been done to the equipment nor was there any loss in operating time. Two filters are installed on each circuit so that one can serve as a by-pass while the other is being cleaned. Although it takes only about fifteen minutes to clean the monel filter insert, even this short interruption in production could be costly in an operation of this size".

MANY OTHERS REPORTING SIMILAR RESULTS ARE NOW SPECIFYING MARVEL SYNCLINAL FLTERS ON ALL NEW HYDRAULIC EQUIPMENT—AND STANDARDIZING WITH MARVEL SYNCLINAL FILTERS ON ALL EXISTING EQUIPMENT

For Dependabale Protection on All Hydraulic and Other Low Pressure Circulating Systems —Investigate MARVEL SYNCLINAL FILTERS

OVER 650

Original Equipment Manufacturers Install them as Standard Equipment!

They Meet J. I. C. Standards

FILTERS FOR ALL TYPES OF FIRE-RESISTANT HYDRAULIC FLUIDS

Marvel's most recent developments is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of Monel mesh sizes range from coarse 30 to fine 200.

IMMEDIATE DELIVERY!

As in the past, Marvel continues to offer Immediate Delivery!

MARVEL ENGINEERING COMPANY

7227 N. Hamlin Ave., Chicago 45, Ill.

Phone: JUniper 8-6023

Catalogs containing complete data available on request

Without obligation, please send me complete data on Marvel Synclinal Filters, as follows:—

- ☐ Catalog #107—For Hydraulic Oils, Coolants and Lubricants
- ☐ Catalog #301—For WATER
- ☐ Catalog #200—For Fire-resistant hydraulic fluids.

Name

Title

Company

Address

City

State

MY-6

BORING BARS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mach. Co., 2442 Douglas St., Rockford, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING, DRILLING AND MILLING MACHINES, Horizontal

(Floor, Planer or Table Types)

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R. Evanston, Cincinnati, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Innocenti Corp., 43 W. 61st St., New York 23, N. Y.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

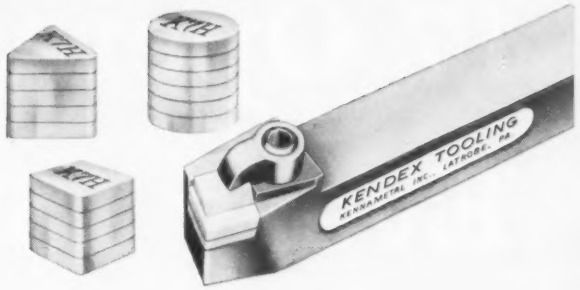
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bryant Chucking Grinder Co., Springfield, Vt.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Wadell Equipment Co., 119 So. Ave., Garwood, N. J.

(*Continued on page* 288)

HERE'S HOW KENNAMETAL*

K7H

CAN FIT INTO YOUR MACHINING OPERATIONS



Kennametal Grade K7H, developed specially for modern high velocity machining and for cutting heat-treated high tensile alloy steels, is showing outstanding results on one new application after another. Its high hardness (93.5 Rockwell A) coupled with phenomenal strength (three times that of the nonmetallics) is proving effective over a considerable range of feeds, depths of cuts and other varied machining conditions. Here are examples:

1. At High Machining Velocities

K7H outperforms oxides at higher velocities: Cutting 4150 steel, K7H outperformed three different oxides, operating up to 1200 sfm. None of the three oxides stood up at that velocity—one broke down early, a second was satisfactory to only 750 sfm, and the third up to 1000 sfm. Grade K7H performed successfully up to 1200 sfm. It also produced freer cutting action, better finish, and showed no noticeable edge wear—even after one mile of cutting.

K7H outperforms other carbides at 1500 sfm: Run at 1500 sfm, cutting irregular flame-cut SAE 1045 steel of 210 Brinnell, Kennametal Grade K7H outperformed previous carbide, which was run at only 255 sfm. Feed increased to .021″ for K7H from .011″ for previous grade, at same ¼″ depth of cut.

2. On Heat-Treated and High Tensile Steels

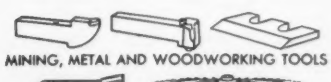
K7H outperforms carbides on SAE 4340: One Kennametal K7H insert with six cutting edges on a Kendex holder completed finish turning and facing five 30″ O.D., 4″ thick plates of heat-treated SAE 4340 of Rockwell C 45–48 hardness, at average surface speed of 600 sfm. A competing premium grade required 3 to 4 cutting edges per plate running at only 400 to 450 sfm. In other words, one K7H edge did the work of three edges of the other carbide. Conditions: Depth of cut 3/32″ to 3/16″, feed .006″ to .008″, with 63 microinch finish required.

K7H more than doubles number of pieces per cutting edge: With K7H run at 750 sfm, it produced 18 pieces per edge as compared with 8 pieces per edge with a competing carbide run at 245 sfm. Other conditions were identical: Depth of cut ¼″, feed .011″, SAE 4140, 28 Rockwell C.

Why not have a Kennametal tool engineer help you take full advantage of this remarkably strong, hard Kennametal grade. Call him or write KENNAMETAL INC., Latrobe, Pennsylvania.

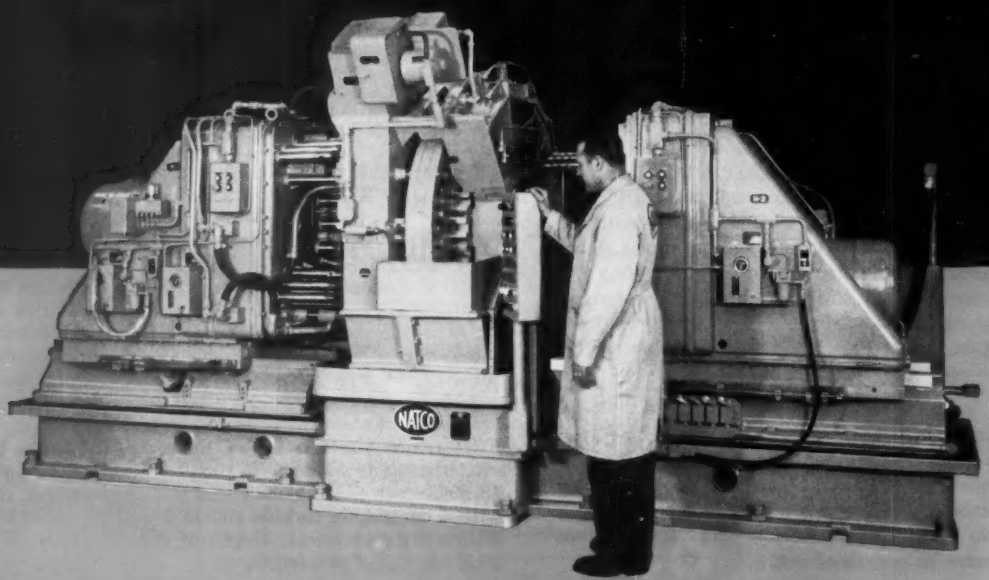
*Registered Trademark

B-3950



INDUSTRY AND
KENNAMETAL
...Partners in Progress

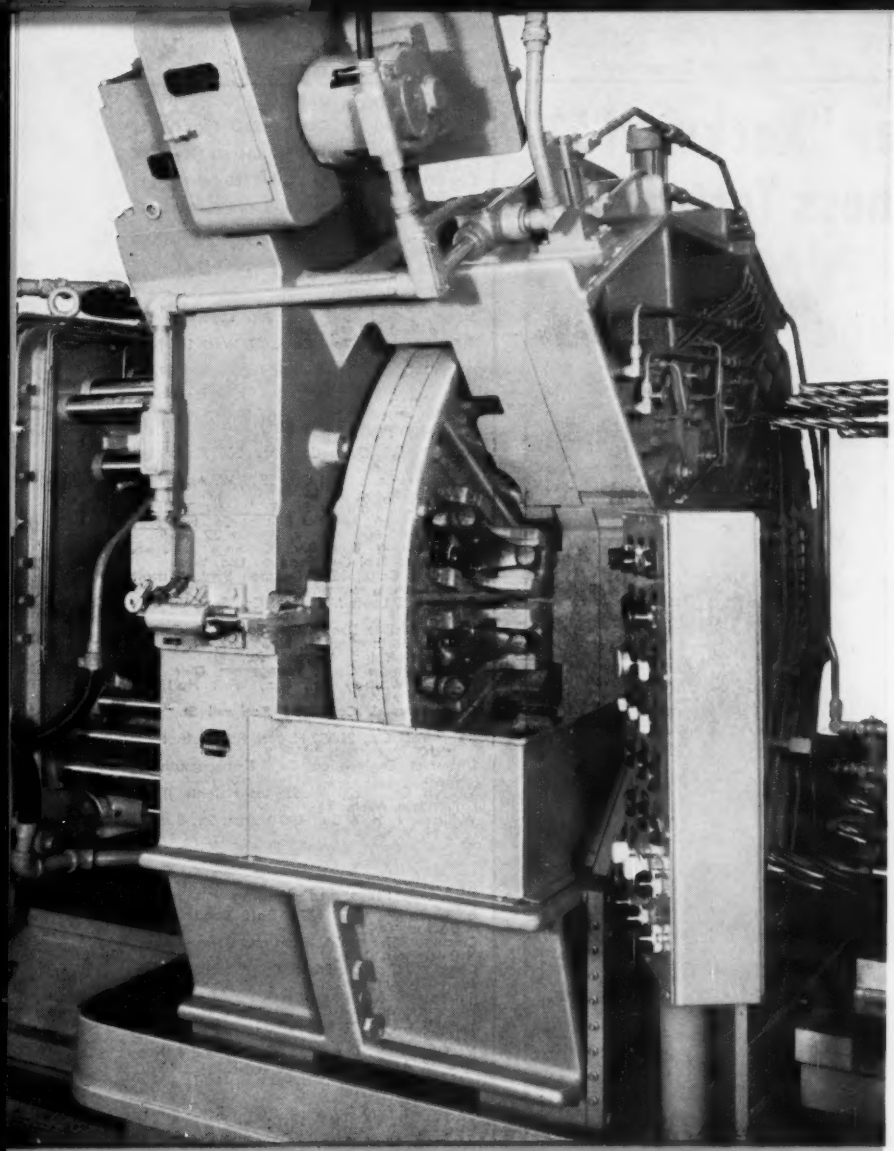
New Natco® Performs 17 Operations Every 15 Seconds



Performance—this Natco 2-way horizontal drilling machine produces 250 steering knuckles per hour. Holds limits as close as .004". Parts are clamped automatically in the interlocked trunnion fixture—spot-drilled, drilled, spotfaced, reamed and counterbored.

Features—Automatic time delay reverse, positive stop, coolant system with magnetic chip separator, automatic lubrication to heads and ways, hydraulic feed and J. I. C. compliance. Let a Natco field engineer help you with your drilling, boring, facing and tapping problems.

Ask for information about the PAYD (Pay-As-You-Depreciate) finance plan.



Notes from Natco...

Whole Hog or Piecemeal

Seems like two distinct approaches are being taken in the adoption of automatic assembly methods. The "whole hog" school favors abrupt change . . . wait until you can install a machine that will handle the *complete* assembly job. The "piecemeal" school favors a step-by-step transition, starting with the basic transfer mechanism and adding automatic stations one or two at a time.

Variety Show

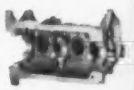
The critics say you can't have high production and versatility, too. But one of our eastern customers has run his drilling show that way for years. On seven adjustable multi-spindle Natcos, he drills and taps over 1000 different parts in lots from 50 to 10,000.

Shuttle for Speed

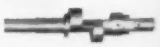
Like the Three Musketeers, drilling, chamfering and tapping go together. Natco is now building sliding tables for their small standard machines allowing all three operations with one push of the button. Starting in drilling position, table automatically indexes for chamfering and tapping; then returns. Up to 24 operations at a crack.

Processed by Natco Machines

Part: Gear Housing
Machine: Natco vertical Holesteel
Operations: Drill 11 holes; Counterbore 1 hole; Chamfer 3 holes; End cut ream 1 hole; Combination ream, face and chamfer 1 hole; Ream 3 holes.
Production: 90 per hour



Part: Cylinder Block
Machine: Natco Holesteel
Operations: Drill 17 holes in 4-cylinder block or 23 holes in 6-cylinder block.
Production: 40 parts per hour



Part: Shaft
Machine: Natco H-5
Operations: Combination drill and chamfer 3 holes; Drill 4 holes.
Production: 80 parts per hour

NATIONAL AUTOMATIC TOOL COMPANY, INC.
Richmond, Indiana

Multiple-spindle drilling, boring, facing and tapping machines
Special machines for automatic production

NATCO

Call Natco offices in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles; distributors in other cities.

ACCO products

Wilson "Rockwell"* Hardness Testers

Production line speeds with laboratory accuracy

• There is a WILSON "ROCKWELL"* Hardness Tester to meet every requirement—from laboratory testing to automatic testing at the rate of 1000 pieces per hour.

J Model
Manually operated

Supplied in both NORMAL and SUPERFICIAL testing types. Designed for testing tools, machine parts and all ferrous and non-ferrous metals, hard or soft, except thin sheet steel.

Y Model Motorized

Suitable for testing work now being done with J models when it is advisable to increase testing speed. Motorized mechanism removes the major load in the test cycle. Set-O-Matic Dial Gauge eliminates need of manually setting dial gauge to zero.

Fully Automatic

Executes complete test cycle automatically at the rate of up to 1000 pieces per hour. Will classify tested parts as "correct," "too hard" and "too soft." Controls hardness limits within two Rockwell numbers. Has safety stop if pieces are not fed properly.

A WILSON hardness testing expert is located near you. Save time and money on your Testing problems. Write or call today.

*Trademark registered

WILSON "ROCKWELL"...
the world's standard of hardness accuracy

ACCO Wilson Mechanical Instrument Division
AMERICAN CHAIN & CABLE
230-D Park Avenue, New York 17, N. Y.

for Better Value

BORING MACHINES, Jig

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING TOOLS

Apex Tool & Cuter Co., Inc., 237 Canal St. Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bliss, E. W., Co., 1375 Raff Road, S. W. Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Detroit, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINE

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Detroit Broach Co., P. O. Box 156, Rochester, Mich.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.

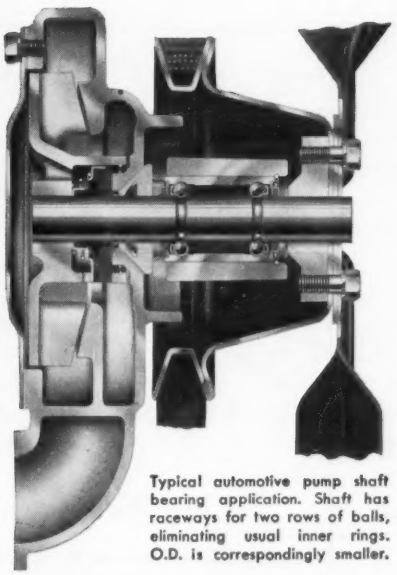
(*Continued on page* 290)

FACTS

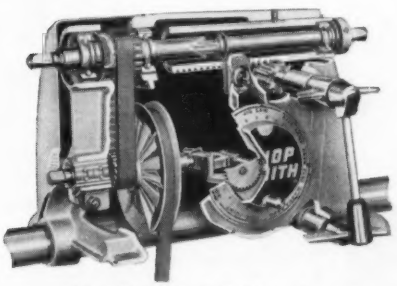
about

NEW DEPARTURE

BALL BEARINGS



Typical automotive pump shaft bearing application. Shaft has raceways for two rows of balls, eliminating usual inner rings. O.D. is correspondingly smaller.



Integral shaft of bearing serves as intermediate shaft in Magna's "Shopsmith". Assures fewer parts, easier machining, more accurate, quicker assembly.

For each McCulloch Mower, New Departure provides two pump shaft bearings with hollow shafts to permit vertical adjustments. Special heat treating gives full hardness at the raceways but adequate toughness in the shaft to withstand hard service.

FAN AND PUMP SHAFT BEARING IS ADAPTABLE TO MANY USES!

This sealed and "lubricated-for-life" bearing with integral shaft was originated by New Departure specifically to simplify automotive fan and water pump mounting. Since its inception, it has reduced bearing maintenance requirements to virtually zero in millions of car, truck and other engines.

Because of its unique design and ability to locate parts on its shaft against loads from any direction, designers find it a highly *versatile* bearing, adaptable to many other uses.

The manufacturer of a well-known power tool, which combines several tools in one compact unit, employs the pump shaft bearing as a complete intermediate shaft with pulleys on one end and a keyway for tool attachment on the other, with obvious design and performance advantages.

Another manufacturer produces a power mower in which two of these versatile NEW Departures with hollow shafts not only support the mower rotors, but permit vertical adjustment of the wheel spindles to regulate cutting height.

So here is another NEW Departure adaptable to many uses. New Departure engineers can show you what it and other ball bearings will do to improve your products.

FINE BALL BEARINGS MAKE GOOD MACHINES BETTER

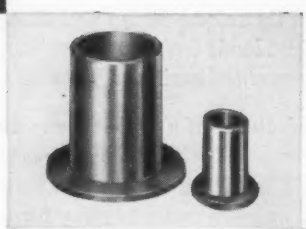
NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

For more information fill in page number on Inquiry Card, on page 229

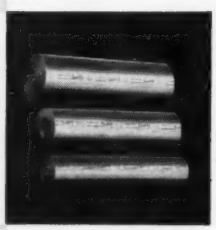
SINTERED POWDERED BRONZE BEARINGS AT THEIR *most modern best!*

Bunting's many years of experience in the manufacture and distribution of Cast Bronze Bearings gives the highest standards of precision, quality and worth to the new Bunting stock sintered Bronze Bearings. These better sintered bronze products are now available from Bunting Distributors.

Bunting's research facilities and resources are producing quality, precision and unvarying uniformity in self-lubricating bearings made of sintered powdered bronze. Plain bearings, flange bearings, thrust bearings and bars made of this increasingly popular material now can be had in sizes and standards not heretofore available from stock.



BOTH Bunting Cast Bronze and Bunting oil filled, self-lubricating sintered powdered Bronze Bearings and Bars are available to you through your nearest Bunting Distributor. He has in stock all sizes for your immediate needs. Ask him or write for complete lists and dimensional data on Bunting Cast Bronze and Bunting Sintered Bronze Bearings.



Bunting®

BUSHINGS, BEARINGS, BARS AND SPECIAL PARTS OF CAST BRONZE AND POWDERED METAL

The Bunting Brass and Bronze Company, Toledo 1, Ohio

Branches in Principal Cities • Distributors Everywhere

Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Bridgeport Brass Co., Bridgeport, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.
Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.

BUFFERS

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Erie Foundry Co., Erie, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BURS

See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.

American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Shenango-Penn Mold Co., Dover, Ohio.

BUSHINGS, Hardened

Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1925 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS

Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

CAM CUTTING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Machine Tool Co., 2351 11th St., Rockford, Ill.

(*Continued on page 292*)

For more information fill in page number on Inquiry Card, on page 229

Often seen in Engineers notebooks

GEAR SOURCES

1. Illinois Gear

A dependable outfit that can fill any gear order. They talk "quality" and that's exactly what they give us. They deliver on time! Emergency service when needed.

They always meet our specs

Ed—
Will use Illinois Gear as our source. I like their quality and service too!
J. R.

Look for this mark ILG® the symbol on finer gears

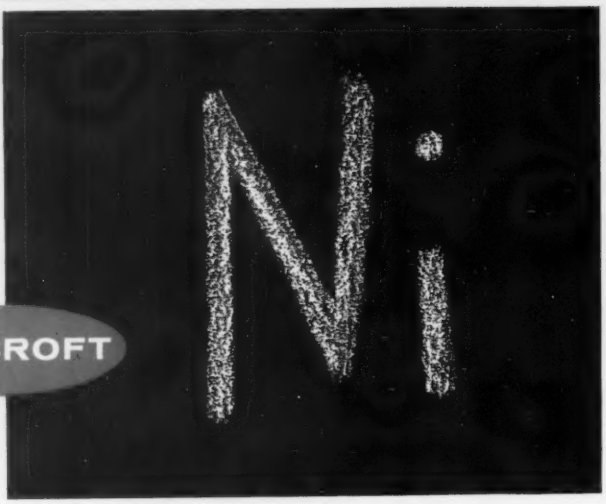
ILLINOIS GEARS Reg. U.S. Pat. Off.

Gears for Every Purpose ... one gear or 10,000 or more

ILLINOIS GEAR & MACHINE COMPANY

2108 NORTH NATCHEZ AVENUE • CHICAGO 35, ILLINOIS

BLAZING THE HEAT TREAT TRAIL WITH HOLCROFT



LET'S TALK ABOUT THE
NICKEL SHORTAGE

Today's shortage of nickel—caused by government stockpiling—has important repercussions for potential buyers of heat treat furnaces.

Heat-resistant alloys may be used in radiant tubes, rails, and other interior sections of the furnace only when nickel is readily available.

That's why we have developed a furnace to meet this challenge—*one that requires no alloys,* yet will meet all the requirements of trouble-free life, low cost, stepped-up production, and high quality control. This is just another example of Holcroft pioneering in furnace design. Better investigate —right now!

OTHER RECENT HOLCROFT FIRSTS

- 1955—Developed a bantam-sized batch furnace using a minimum of alloys.
- 1954—Developed "Lo-Dew" generator for producing exothermic and endothermic atmospheres.
- 1951—Installed silicon carbide skid rails in conveyorized furnaces.

HOLCROFT AND COMPANY
6545 EPWORTH BOULEVARD • DETROIT 10, MICHIGAN
PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE
CHICAGO, ILL. • CLEVELAND, OHIO • DARIEN, CONN. • HOUSTON, TEXAS • LOS ANGELES, CALIF. • PHILADELPHIA, PA.
CANADA: Walker Metal Products, Ltd., Windsor, Ontario

CAM MILLING AND GRINDING MACHINES
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CASEHARDENING FURNACES
See Furnaces, Heat-Treating

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.
Shenango-Penn Mold Co., Dover, Ohio.

CASTINGS, DIE
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wisc.

CASTINGS, Iron
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Shenango-Penn Mold Co., Dover, Ohio.

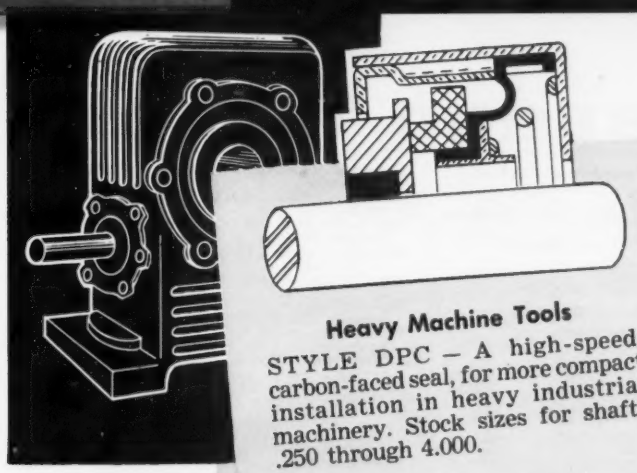
CASTINGS, Steel, Alloys, Etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfeld, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

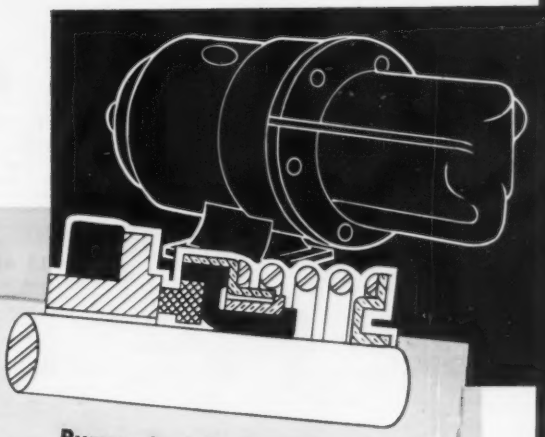
(Continued on page 294)

For more information fill in page number on Inquiry Card, on page 229



Heavy Machine Tools

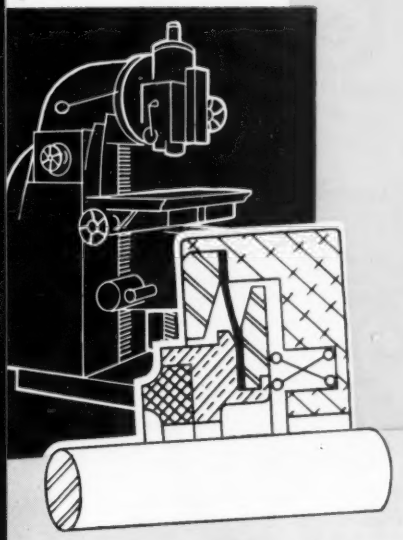
STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.



Pumps And Compressors

ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.



Machine Tools And Power Transmission Equipment

STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.

A Complete Line

GITS SHAFT SEALS

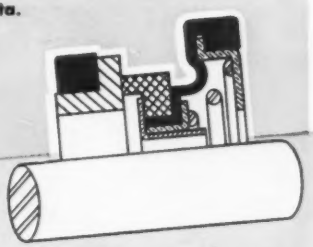
For Every Application

These modern, mechanical, face-type seals are carried in stock — to save you time and money. Write for detailed data.

GITS BROS. MFG. CO.

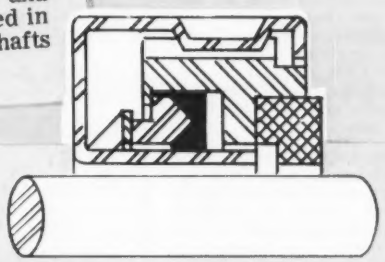
1858 South Kilbourn Avenue • Chicago 23, Illinois

Specialists In Lubricating Devices And Shaft Seals For Almost Half-A-Century



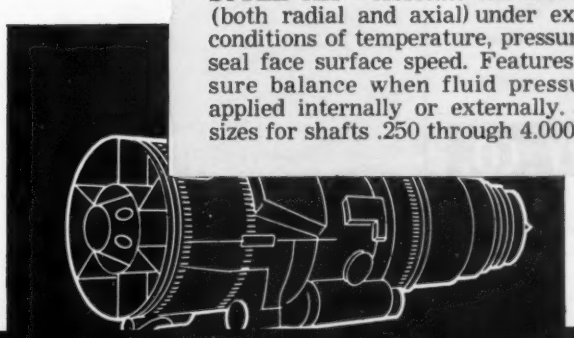
Household Appliances

STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.



Aircraft Engines And Accessories

STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.



CENTERS, Lathe

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

CHUCKING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co. (Single and Multiple Spindle), 170 E. 131st St., Cleveland, Ohio.
Potter and Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfeld 7, Mass.

CHUCKS, Drill

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.
Horton Chuck, Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet Ave., Chicago 16, Ill.

CHUCKS, Lathes, etc.

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

(*Continued on page* 298)

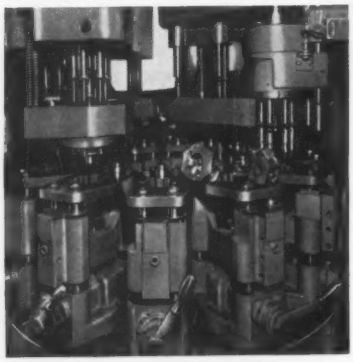
MILLHOLLAND

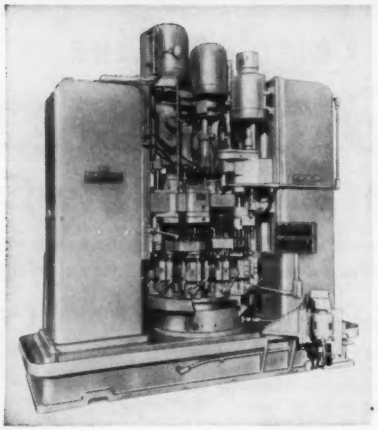
12-Station Vertical Indexing Machine

34 Spindles!

93 Pieces per Hour!

Here is Millholland versatility in action!





Lead Screw Tapper with reversing motor drives a 6-spindle tapping head. All machine elements are electrically synchronized, with push-button control for "cycle start," automatic single cycle, set-up and emergency stop. Chip disposal is simplified with wiper blades rotating within a ring on the index table to bring chips to a removable pan.

Unique Holding Fixture

With a 31-second cycle time, this machine produces 93 pieces per hour at 80% efficiency! This chip cutting efficiency is made possible by the distinctive design of the plate type cam used in Millholland Automatic Units, plus the action of the pneumatic counterbalance.

Two No. 5 Units are mounted vertically, the first with 22 spindles, the second with 5; a No. 2 unit is mounted horizontally on a rapid travel slide, and an Automatic

Part requirements dictated location using self-centering horizontal vees with up-acting clamps, actuated by a single handle operating through a small arc. Fixtures also contain register pins for all bushing plates. The 12 fixtures are mounted on an independently powered automatic index table with self-contained lubrication pump.

A complex production problem, solved efficiently with Millholland equipment and Millholland know-how.

Write for Bulletin M-6 giving further details.

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd. Indianapolis 20, Indiana

REPEAT ORDERS

...the true measure of Customer Satisfaction

A NORRIS-THERMADOR PRESS LINE shows bathtubs being drawn in a single operation on the versatile 6000 ton Lake Erie press at the left. The tubs move down the line where they are trimmed on a 1500 ton Lake Erie and flanged on a 3000 ton Lake Erie. Norris-Thermador Corporation serves many segments of the consumer, industrial and military markets with products from eight manufacturing plants.

NORRIS-THERMADOR CORPORATION

has re-ordered Lake Erie Presses nearly **40 TIMES**

Ask about 16mm, sound, color film "Pressure on Metalworking Production".

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

No endorsement for a product is more convincing than a repeat order . . . unless it is dozens of repeat orders! Norris-Thermador purchased its first "Lake Erie" in 1940 and has since run the total to more than 80 presses. In a recent letter, Mr. Kenneth T. Norris, President of Norris-Thermador Corporation, said: "It has now been fifteen years since we installed our first Lake Erie hydraulic press and it is still operating day in and day out in an entirely satisfactory manner."

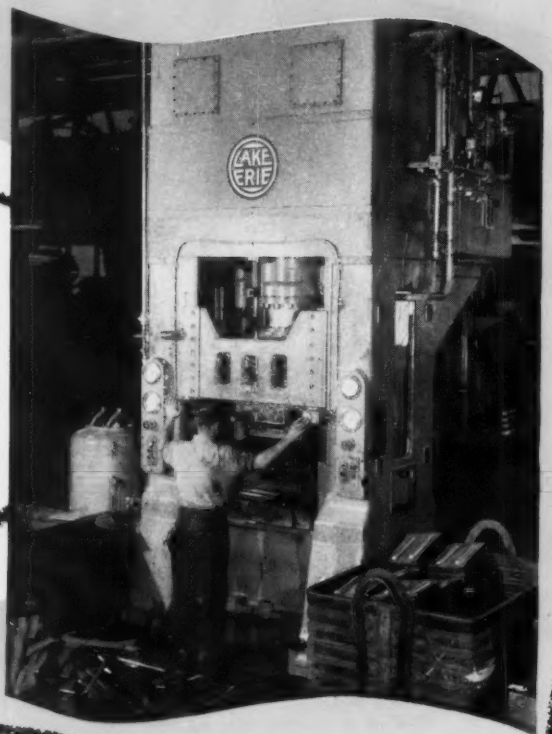
LAKE ERIE ENGINEERING CORP.

General Offices and Plant: 470 *Woodward Ave., Buffalo 17, N.Y.*
District Offices in New York, Chicago, Detroit, Pittsburgh
Representatives in other U. S. Cities and Foreign Countries

LAKE ERIE® • **Manufacturers of die casting machines and the most complete line of hydraulic presses for all industry.**

SURE SIGN OF SATISFACTION

...Repeat orders



ONE OF THE MANY
"Lake Eries" serving "IH" is this 200 ton, side housing, single action press with cushion. Press has an 18" stroke, 36" x 38" bed, closing and return speed of 750"/min., and pressing speed of 67"/min.

INTERNATIONAL HARVESTER

has re-ordered from Lake Erie **19 TIMES**

International Harvester Company ordered their first press from us in the early 40's . . . have added 21 more Lake Erie presses since then . . . and have a current order on our books. Drawing, forging, hot forming, bending, quenching and straightening are some of the many production operations performed by International Harvester with their Lake Erie presses.

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

LAKE ERIE ENGINEERING CORP.

General Offices and Plant: 470 Woodward Ave., Buffalo 17, N.Y.
District Offices in New York, Chicago, Detroit, Pittsburgh
Representatives in other U. S. Cities and Foreign Countries

LAKE ERIE® • **Manufacturers of die casting machines and the most complete line of hydraulic presses for all industry.**

For more information fill in page number on Inquiry Card, on page 229

Saves Time... Cuts Costs

Rotary Planer • • • do milling jobs in one-third to one-seventh of time on an Espen-Lucas Rotary Planer.

Big Sawing • • • production cutting of large stock —rapid, easy, straight-to-a-line piece after piece—on Espen-Lucas Cold Sawing Machines.

The **ESPEN-LUCAS** *Machine Works*

Front Street and Girard Ave., Phila. 23, Pa.

BUILDERS OF LARGE COLD SAWING MACHINES • ROTARY PLANERS • COLUMN FACERS • HEAVY TYPES OF SPECIAL MACHINERY

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Buck Tool Co., 220 Schippers Lane, Kalamazoo, Mich.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co. 254 N. Laurel Ave., Des. Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS

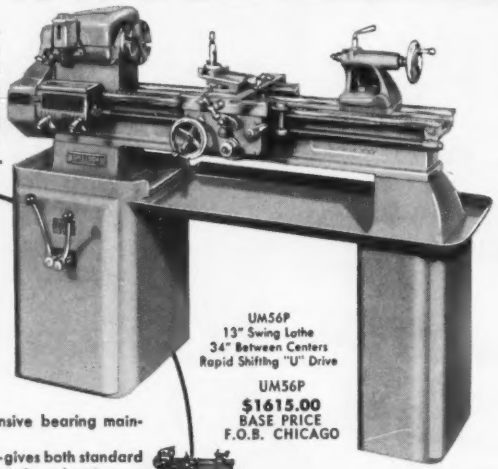
General Electric Co., Schenectady 5, N. Y.

SHELDON

CHICAGO U. S. A.

BUILT • • • to Turn out PROFITS

Sheldon Lathes are designed and built to do accurate lathe work rapidly and profitably. Moderate in price they have the collet, swing and power capacity to do most toolroom work.



UM56P
13" Swing Lathe
34" Between Centers
Rapid Shifting "U" Drive

UM56P
$1615.00
BASE PRICE
F.O.B. CHICAGO

Design Features:

- **Large and wide "Zero Precision" Tapered Roller Spindle Bearings**—permit operation at all speeds, retain accuracy, end expensive bearing maintenance costs.
- **54-pitch Gear Box**—gives both standard and many hard to get thread ratios.
- **Large Micrometer Dials**—Make accurate operation easier.
- **Extra Collet Capacity**—1⅜" hole through spindles available on 10", 11" and 13" swing lathes.
- **More Power to Spindle**—Efficient drives with bigger motors and double neoprene V-belts to spindle.

OPTIONAL FEATURES AT EXTRA COST

include: Hardened ways, Long Tapered Key Drive Spindles, 4" D1 Camlock Spindles bed turrets, collet attachments, and other production and toolroom accessories. Lathes available with a choice of "Bench," "Cabinet" or "Pedestal" mountings.

Write for New Catalog G-55

SHELDON MACHINE CO., Inc.

4246 N. Knox Ave. • Chicago 41, Illinois

CLAMPS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal

Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
International Chemical Co., 2628 N. Mascher St., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES

Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave. Warren, Ohio.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

COLLARS, Safety

Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los. Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St. Cincinnati 12, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

COMPARATORS

See Gages, Comparator

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
International Chemical Co., 2628 N. Mascher St., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
International Chemical Co., 2628 N. Mascher St., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lapping).

(*Continued on page* 300)

Chances are at least **98 out of 100** that this part will be **perfect**

The Metal Stampings Plant, Sylvania Electric Products, Inc., keeps rejects under 2%—even on complex, close-tolerance parts produced at rates to 9,000 per hour. Optical gaging helps set this level.

The diode plate shown above is an example of the complex, mass-produced, parts turned out to close tolerances by The Metal Stampings Plant, Sylvania Electric Products, Inc., at York, Pennsylvania. Tolerances run to ± .001″; as many as 10 dimensions must be held, including inner and outer diameters. Yet even on parts more difficult than this—parts with tolerances of .0005″ and forming rates of 9,000 per hour—Sylvania gets an acceptance rate of over 98%.

Inspection on Kodak Contour Projectors helps Sylvania do the job to the satisfaction of its customers, both internal and external. Operators check the first parts produced by every machine to assure correct setup. Then, throughout the run, production samples are checked at regular intervals—making certain each machine is holding to tolerance. The speed with which these parts can be checked using optical gaging methods has helped slash rejection rates more than 50% since Kodak Contour Projectors were installed.

If you have difficult inspection problems involving quantity, speed, close tolerances or hard-to-measure dimensions like shoulders, holes, radii or angles, there's every reason to expect a solution by optical gaging on a Kodak Contour Projector. There's a representative in your area who can tell you more. To get in touch with him, or for a copy of the booklet, "Projection Gaging with Kodak Contour Projectors," write Special Products Sales Division.

Little training is required to operate a Kodak Contour Projector. Operators sit comfortably in a fully lighted room. The work gets out in a hurry.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE-MARK

AIRengineering at work

REPORT No. 5098B-3

Multiple Screw Driver

assembles 400

carburetors per hour

Assembling carburetors was a slow, one-screw-at-a-time operation until AIR engineering solved the bottleneck. Now one operator uses this 8-spindle automatic Multiple Screw Driver to help turn out more than 6 completed carburetors per minute—400 every hour.

This compact, easy-to-operate Multiple Screw Driver is just one more example of how AIR engineering is helping modern industry solve problems and cut production time and costs.

All the experience of Ingersoll-Rand in speeding up fastening through AIR engineering multiple units is yours for the asking. Whether your operations involve screw-driving or nut running with either hand-held or automatic production line units, Ingersoll-Rand can engineer and build just the unit best suited to your needs.

8-Spindle Multiple Screw Driver for carburetor assembly.

Drop us a line if you'd like an AIR engineer to analyze and make recommendations on your fastening operations.

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

8-341

Oakite Products, Inc., 19 Rector St., New York, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

COMPOUNDS, Resin and Molding

General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Fellows Gear Shaper Co., Springfield, Vt.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Lees-Bradner Co., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett, Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfeld St., Dayton 1, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

COOLANT SEPARATORS

See Separators, Oil or Coolant

COOLANT SYSTEMS

Gray-Mills Co., 1948-52 Ridge Ave., Evanston, Ill.

COPPER

American Brass Co., 25 Broadway, New York N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

COUNTERBORES

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cello-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 52nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

COUNTERSHAFTS
Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS
Besly-Welles Corp., 112 Dearborn Ave., Beliot, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

COUNTERS, Revolution
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

COUNTING DEVICES
Starrett, The L. S., Co., Athol Mass.

COUPLINGS, Flexible
Boston Gear Works 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.

COUPLINGS, Shaft
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co. 7171 E. McNichols Rd., Detroit 12, Mich.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling
Cleveland Crane & Engrg Co., Wickliffe, Ohio.

CUTTER GRINDERS
See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.
(*Continued on page* 302)

Have you seen what this CAN DO FOR YOU?

SIZE 5040T* TORSION BAR

Torque control IMPACTOOL

NEW accuracy and speed for precision nut running jobs . . .

- **POSITIVE TORQUE CONTROL**—a revolutionary use of a rugged steel torsion bar for precision control of torque—combined with the power and speed of the Impactool.
- **SIMPLE TORQUE SETTING**—torsion bar adjusting sleeve is clearly calibrated for changing torque with easy-to-use torque jig.
- **TORQUE SETTING REMAINS CONSTANT**—for any nut running condition until the adjustment is changed.
- **ELIMINATES "OVER-TORQUE"**—impact mechanism rebounds instantly when preset torque is reached, tripping a foolproof rubber faced shutoff valve.
- **LOW MAINTENANCE**—combines many of the proven features of Ingersoll-Rand Impactools, with their enviable record of dependable performance and low maintenance.
- **REVERSIBLE**—full power in either direction.
- **NO CLUTCH**—to wear, slip or require adjustments.

* **2 TORSION BARS PROVIDE MULTIPLE TORQUE SETTINGS**

- No. L735 Max. torque 60 ft. lbs.
- No. H735 Max. torque 90 ft. lbs.

For torques up to 550 ft. lbs. a Size 5340T Torque Control Impactool is available.

Get a free demonstration of Ingersoll-Rand Torque Control Impactools by an I-R AIR engineer now... or write for additional information.

Ingersoll-Rand
11 Broadway, New York 4, N. Y.
8-342 IMPACTOOL DIVISION

How
SHENANGO
CENTRIFUGAL
CASTINGS
pay off!
CENTRIFUGALLY CAST FOR PRESSURE SERVICE. This large sluice gate operating cylinder, assembled by precise shrink fit as shown here, will safely handle pressures up to 250 psi. The Meehanite Metal cylinder housing, sleeved with a bronze liner 20" in diameter . . . are both centrifugally cast by Shenango for increased tensile strength and improved resistance to wear, stress and abrasion. For complete information on rough finished, semi-machined or precision-machined parts, ferrous or non-ferrous, write to: Shenango-Penn Mold Company, Centrifugal Castings Division, Dover, Ohio.
SHENANGO
CENTRIFUGAL CASTINGS
COPPER, TIN, LEAD, ZINC BRONZES • ALUMINUM AND MANGANESE BRONZES
MONEL METAL • NI-RESIST • MEEHANITE METAL • ALLOY IRONS

CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Twist Drill & Tl. Co., Rochester, Mich.
Waltham Mch. Works, Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greefield, Mass.
Ex-Cello-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Wesson Co. 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Rotary

See Files & Burrs Rotary

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.

(*Continued on page* 304)

Why the Die Maker Prefers PRODUCTO Die Sets

Volkert Stampings, Inc.

The die maker likes to work with Producto Die Sets

He knows Producto die sets are easy to assemble —especially those equipped with the unique new Qwik-Fit Guide Pins*.

He has confidence in the consistent accuracy of Producto sets. He has found that they always align his dies correctly.

He knows he can choose from a variety of thicknesses the Producto die set that meets the strength requirements of his die.

He favors Producto die sets because they are dependable. They will perform on the press as well as they did in tryout.

He likes the attractive, streamlined appearance of Producto sets. They make his dies look better and increase his pride in these products of his craftsmanship.

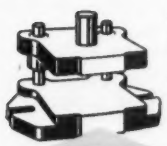
*Patent Pending

He knows that a nearby Producto warehouse can supply any catalog die set he needs...and that orders for specials are promptly processed. He can count on having the die set by the time he needs it.

The die maker has found that all of his requirements are met by Producto die sets. You will, too, when you place your order with Producto.

DIE SET DIGEST, our eight-page quarterly, contains valuable data for designers, makers and users of dies. Write to have your name added to mailing list.

THE PRODUCTO MACHINE COMPANY
985 Housatonic Ave., Bridgeport 1, Connecticut



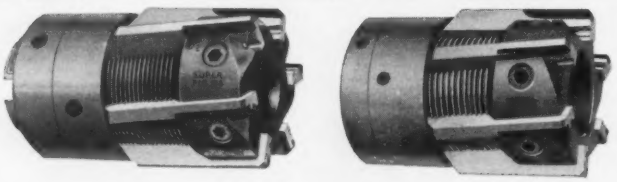
PRODUCTO

Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

McCROSKY



Super® Adjustable REAMERS

Chucking and Shell Designs

Sizes from 15/16" to 6" in Diameter

● McCrosky Reamers combine the strength of solid reamers with the longer life, greater accuracy and lower cost of replaceable blade reamers. They cut freely without chatter, avoid any tendency to "dig in", and produce absolutely round, concentric holes with high finish. Our pin and screw blade locking device permits the blades to be released easily, and adjusted and reground quickly and accurately. Machine chucking and shell designs. High speed, cast alloy and carbide tipped blades. You'll produce more pieces — better — at lower cost with McCrosky Reamers. *Write for a bulletin today!*

WRITE FOR THE McCROSKY BULLETINS
. . . Send the coupon today!

McCROSKY TOOL CORPORATION
1353 Main Street
Meadville, Penna.

COST CUTTING TOOLS

Gentlemen:

Please send Bulletins describing the tools checked below.

☐ Jack-Lock® MILLING CUTTERS
☐ Block-Type BORING BARS
☐ Super® Adjustable REAMERS
☐ Turret TOOL POSTS
☐ Wizard® QUICK-CHANGE CHUCKS
☐ Specially Engineered MULTIPLE PRODUCTION TOOLS

Name_____ Title_____

Company_____

Address_____

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Landis Machine Co., Waynesboro, Pa., (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel

Campbell Machine Div., American Chain & Cable, Bridgeport, Conn.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hamilton Div., The Lodge & Shipley Co., Hamilton 1, Ohio.

CUTTING-OFF MACHINES, Cold Saw

See Sawing Machines, Circular

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York N. Y.
Kennametal, Inc., Latrobe, Pa.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo.

CUTTING-OFF WHEELS, Abrasive

Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Farley Sts., Philadelphia 37, Pa.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2424 Douglas St., Rockford, Ill.
Michigan Drill Head Co., Detroit 34, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air

Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Logansport Machine Co. Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Shenango-Penn Mold Co., Dover, Ohio.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Pneumatic

Shenango-Penn Mold Co., Dover, Ohio.

DEALERS, Machinery

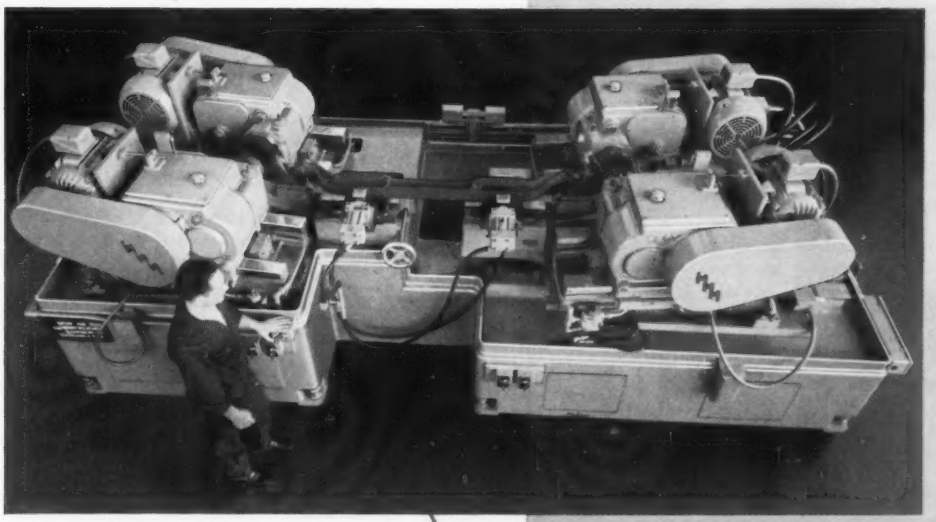
Falk Machinery Co., 18 Ward St., Rochester, N. Y.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

(*Continued on page* 306)

MIGHTY BIG JOB

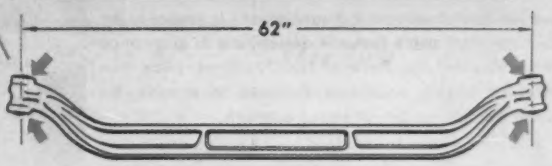
MINIMIZED by another

MOTCH & MERRYWEATHER *Production Solution*



Traveling head universal double duplex milling machine.

YOU'RE AHEAD WITH A HEAD FOR EACH SURFACE



Operation: Milling kingpin bosses of truck axle.
Material: . . . . . Forged steel.
Brinnel Hardness: . . . . . 217-255.
Machine cycle time: . . . . . 30 seconds

Four faces of a part are milled simultaneously by this universal-special machine. Mill faster, more accurately, at less cost with a head for each surface. Motch & Merryweather engineers can design universatility into special equipment. Thus, machines performing a specific task can be quickly adapted to a variety of sizes. Have M. & M. study your next job with a view to broadening the usefulness of ostensibly special equipment.

Write for Bulletin S-56 describing M. & M. Duplex Milling Machinery.

THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

Builders of Automatic Precision Cut-off, Milling and Special Machinery

For more information fill in page number on Inquiry Card, on page 229

DEMAGNETIZERS
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Walker, O. S. Inc., Worcester, Mass.

DESIGNERS, Machine and Tool
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Specialty Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co. 14230 Birwood Ave., Detroit 4, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DIE-CASTING
See Castings, Die

DIE-CASTING MACHINES
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.

DIE CUSHIONS
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St. Chicago, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Kennamental Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.

DIEMAKERS' SUPPLIES
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Producto Mch. Co., 990 Housatonic Ave., Brdigeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mach. Co., Oakley, Cincinnati 9, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.

DIE SETS, Standard
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridegport, Conn.
U. S. Tool Co., Inc., 225 N. 18th St., Ampere, N. J.
Wales-Strippet Corp., North Tonawanda, N. Y.

DIE-SINKING MACHINES
American Crucible Products Co., 1395 Oberlin Ave., Lorain, Ohio
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.

DIE-SINKING PRESSES
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

DIE STOCKS
See Stocks, Die

DIES, Lettering and Embossing
Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

DIES, Sheet Metal, Etc.
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept. General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mach Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Waltham Mch. Wks., Newton St., Waltham, Mass.

DIES, Threading
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.

DIES, Threading, Opening
Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

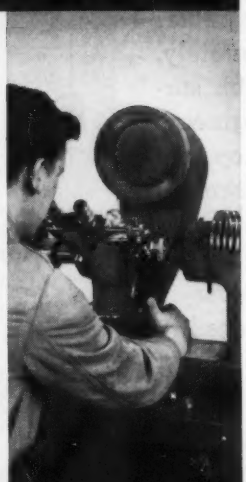
DIES, Thread Rolling
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

DISCS, Abrasives
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.

(*Continued on page* 308)

Another of the Reasons Behind Brad Foote Quality—

METALLOGRAPHY



• The heat treatment a gear receives is probably the most important single factor in determining its long range wear characteristics. Here at BRAD FOOTE we pride ourselves on having equipment designed to provide the widest possible variety of heat treatments.

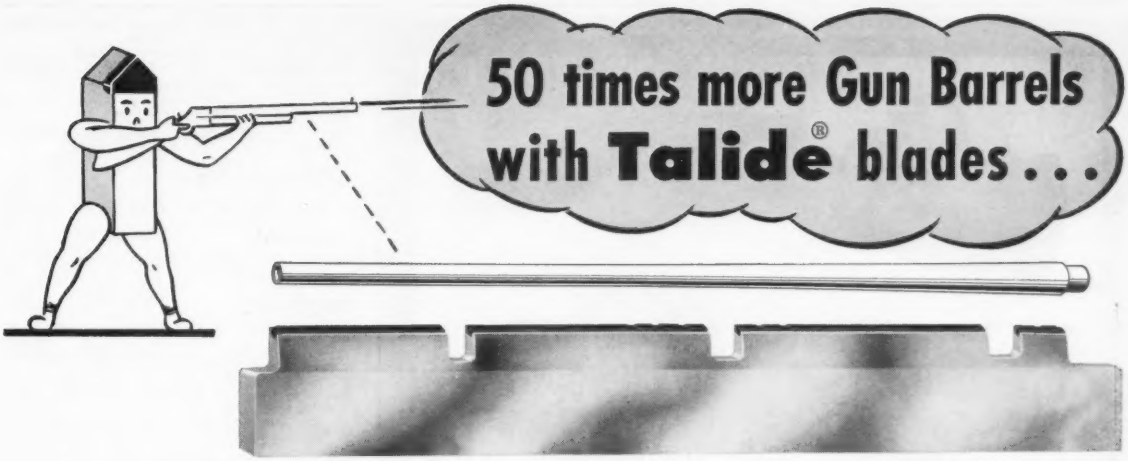
• But in addition to standard heat treating and testing equipment we have a few extra safeguards. One of these, rather unusual in our business, is a complete Metallographic laboratory. Specialized equipment allows us to examine or photograph the grain structure of all of our metals, in order to determine the most effective methods of heat treatment and to serve as a check on the quality of finished work.

• Metallographic examination is just one of the many reasons behind BRAD FOOTE quality. Prove to yourself the savings this extra quality can mean. Let us quote on the gear requirements for your next program, without obligation.

BRAD FOOTE MAKES ALL TYPES OF GEARS—IN A COMPLETE RANGE OF STYLES AND SIZES

BRAD FOOTE GEAR WORKS, INC.
1309 South Cicero Avenue - Cicero 50, Illinois
Bishop 2-1070 • OLympic 2-7700 • TWX CIC-2856-U

subsidiaries
AMERICAN GEAR & MFG. CO. Lemont, Illinois • Phone Lemont 920
PITTSBURGH GEAR COMPANY Pittsburgh 25, Penn. • Phone SPalding 1-4600



Leading Arms Producer reports outstanding service life with Talide centerless blades over past 10 years—outperforming and outlasting all other work support blades.

Part..... 12 gauge shotgun barrel.

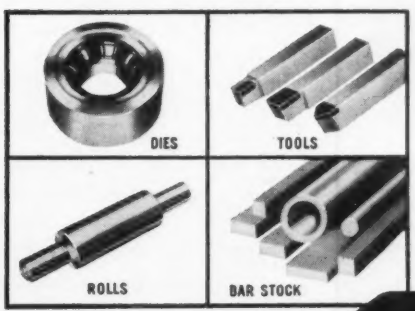
Operation..... Grind entire gun barrel simultaneously to series of compound angles.

Machine..... No. 5 Cincinnati Centerless Grinder.

Blade..... Special Talide-tipped work support blade 34⅜" long, having 9 steps and 10 compound angles ground to .0001" tolerance.

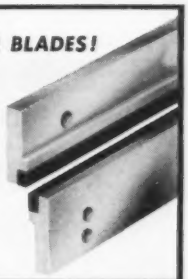
Results..... Talide-tipped blades last 150 days per grind—hardened steel blades 3 days. Several Talide blades have been in continuous production for over 5 years—being retipped with a new Talide metal wear strip every 12 to 18 months.

Tolerance..... Talide blades, due to their negligible wear over long periods of service, enabled the above Arms Producer to maintain the extremely close tolerances required on the above part—and at less cost than possible with any other tooling.



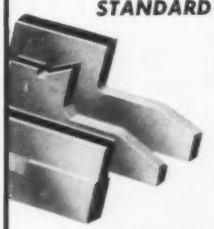
One-piece Talide strip (up to 100" without seams) prevents scoring and scratching. Write for new 84-page Catalog 56-G or ask for sales engineer to call. . . . Metal Carbides Corporation, Youngstown 12, Ohio.

1,000,000 CUTS WITH TALIDE SHEAR BLADES!



A large mid-west electrical equipment manufacturer reports exceptional service life with Talide-tipped shear blades 39" long cutting silicon steel for transformers. Over 1,000,000 cuts are being obtained per blade, compared to 8,000 cuts with a hi-carbon, hi-chrome blade. Burr-free, clean-cut edges produced with scrap rate practically eliminated.

STANDARD OR SPECIAL CENTERLESS BLADES!



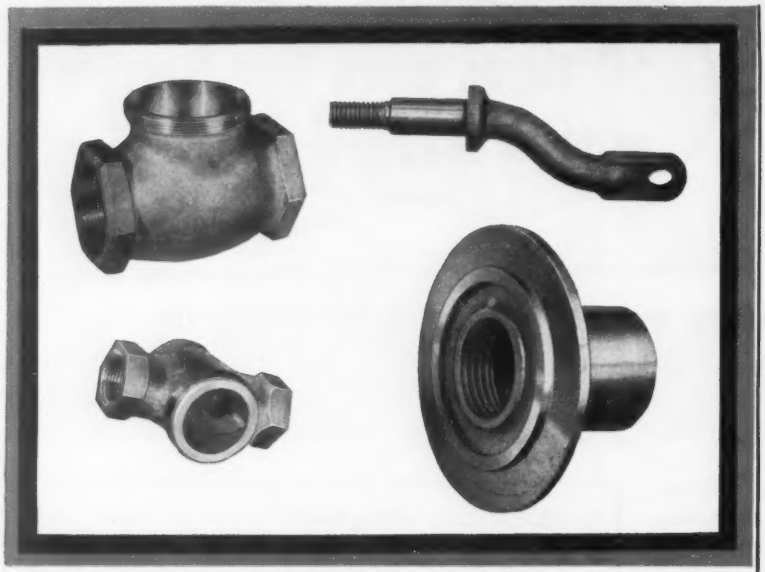
Standard Talide-tipped blades are available from stock in over 50 styles and sizes for both Cincinnati and Landis Centerless Grinders and for either infeed or thru-feed work. Special blades to handle parts having steps, tapers or profiles can be made promptly to special order. Blades can be supplied in lengths up to 100" and ground to any tolerance or shape.

4,600 MILES OF SCOTCH TAPE CUT!

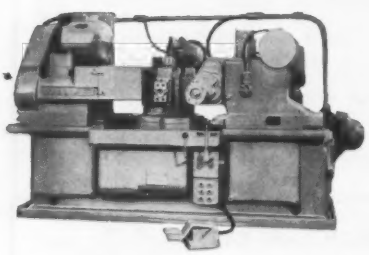
A leading producer of scotch tape installed a set of Talide rotary slitter knives 5 years ago on a line cutting scotch tape to size. The original set of knives have, to date, cut 7,000,000 yards of scotch tape with no signs of wear—no resharpening—and no downtime experienced. Officials have decided to equip over 100 shearing machines with Talide knives as a result of the above phenomenal performance.

METAL CARBIDES CORPORATION
TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • CERMETS • HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

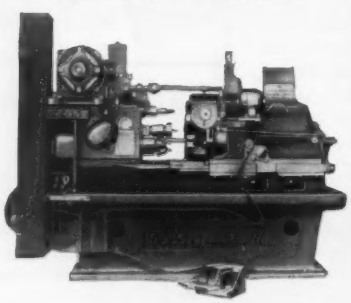


PLAN PRODUCTION of
PARTS LIKE THESE and MANY OTHERS . . .
for speed, convenience and economy
on GOSS & DeLEEUW
AUTOMATIC CHUCKERS



The "ONE-TWO-THREE" 7-Spindle TOOL ROTATING CHUCKING MACHINE

can complete in one operation as many as three ends of valve bodies, plumbing fittings, etc. eliminating secondary operations.



4-SPINDLE TOOL ROTATING CHUCKING MACHINES,

available in three sizes, combine various turning, boring, facing, threading, multiple drilling and tapping operations on a wide range of single-ended parts.

Send samples of your work for time estimates. Ask for illustrated literature.

GOSS & DeLEEUW
QUALITY PRODUCT-QUANTITY PRODUCTION

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Thor Power Tool Co., Aurora, Illinois
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

DISINTEGRATORS

Elox Corp., 602 N. Rochester Rd., Clawson, Mich.

DIVIDING HEADS

See Indexing and Spacing Equipment

DOLLIES

Mighty Mover Co., 1482 S. Milwaukee St., Denver 10, Colo.

DOWEL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRESSERS, Grinding Wheel

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper St., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.

DRIFTS, DRILL

Armstrong, Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

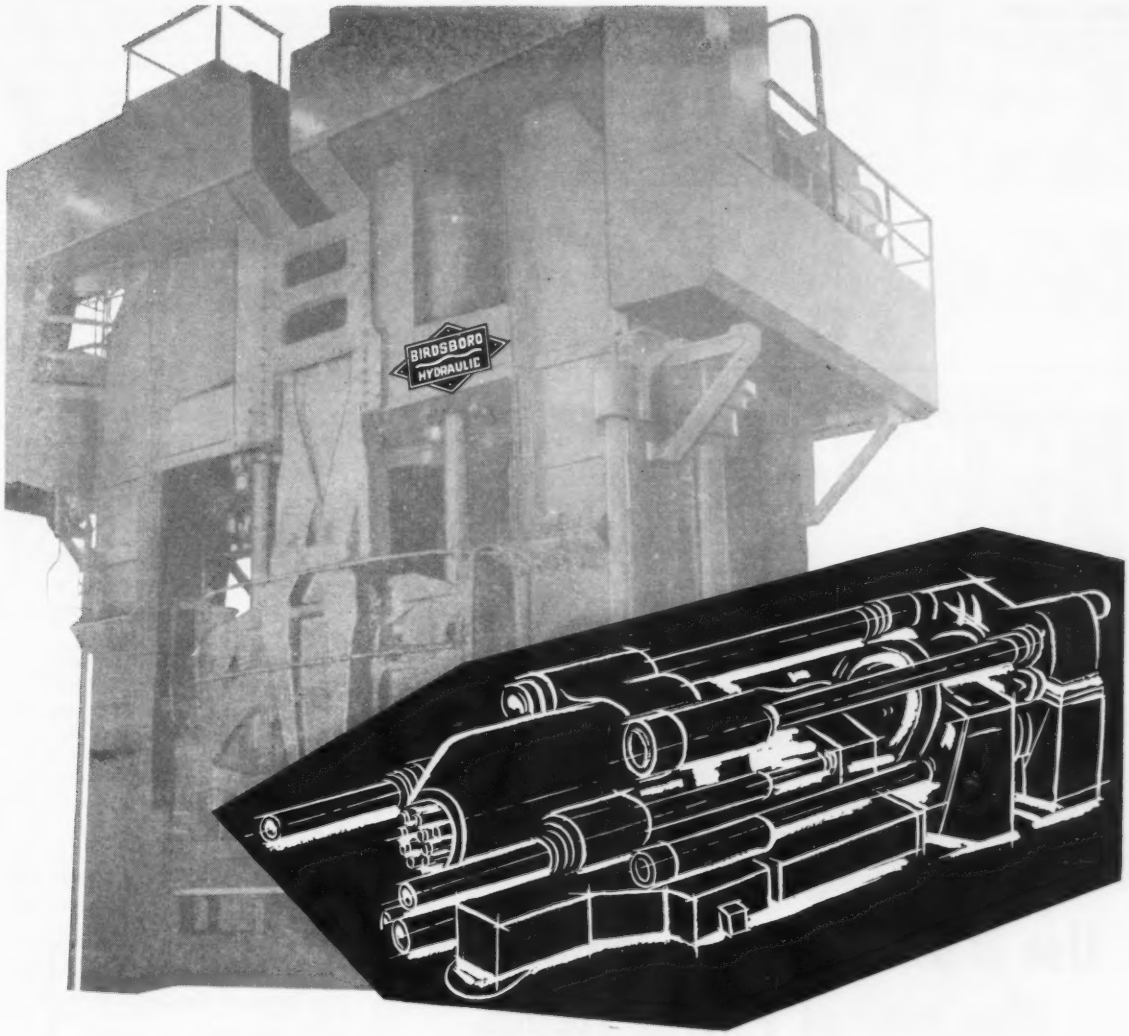
DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Govro-Nelson Co., 1933 Antoinette St., Detroit 8, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6302 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.

(Continued on page 310)



Built to meet the demands of the future for greater speed, accuracy, versatility

Designers and Builders of:

STEEL MILL MACHINERY
HYDRAULIC PRESSES
CRUSHING MACHINERY
SPECIAL MACHINERY
STEEL CASTINGS
Weldments "CAST-WELD" Design
ROLLS: Steel, Alloy Iron, Alloy Steel

● Automation, new metals and industrial diversification are demanding better performance from hydraulic presses today. Rapid developments in all branches of industry will continue to require even greater performance feats in the years to come. BIRDSBORO design engineers are already meeting the challenges of the future with presses built to serve you efficiently today and for many tomorrows. Call your Birdsboro representative today . . . he's already thinking about tomorrow.

HP 56-26

BIRDSBORO

BIRDSBORO STEEL FOUNDRY & MACHINE CO., Main Offices in Birdsboro, Pa. District Office: Pittsburgh, Pa.

New York Office: **Engineering Supervision Co.,** *743 Fifth Ave., New York 22, N.Y.*

For more information fill in page number on Inquiry Card, on page 229

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLING MACHINES, Automatic

Avey Drilling Mach., Co., 26 Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridegport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kingsbury Mch. Tool Corp. Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippet Corp., North Tonawanda, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Bench

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 126 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

DRILLING MACHINES, Boiler

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

DRILLING MACHINES, Deep Hole

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Gang

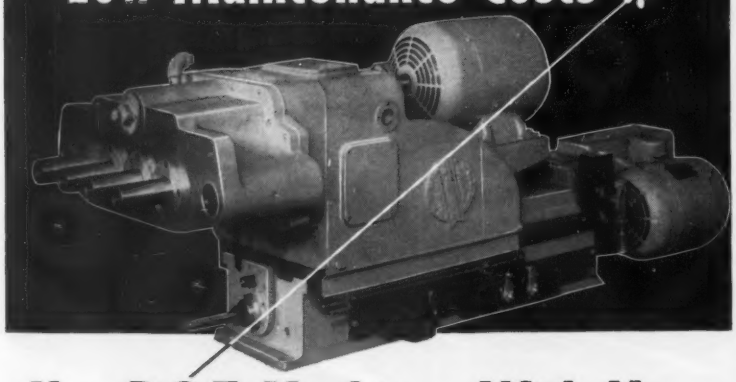
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Horiz.

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.

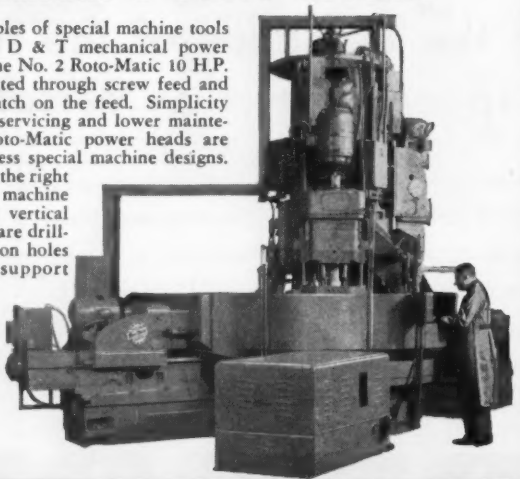
(*Continued on page* 312)

For High Production and Low Maintenance Costs *



Use D&T Machines With New Mechanical Power Heads

Here are two good examples of special machine tools designed and built with D & T mechanical power heads. Shown above, is the No. 2 Roto-Matic 10 H.P. head. All sizes are operated through screw feed and have overload release clutch on the feed. Simplicity of design makes for less servicing and lower maintenance costs. D & T Roto-Matic power heads are readily adapted to countless special machine designs. For instance: Machine to the right is a 6 station indexing machine with 3 horizontal and 3 vertical power heads. Operations are drilling and reaming suspension holes and king pin holes in support arms for power heads.



Free Data

is available on the complete line of D & T machines. Ask for Bulletin 1000.

DAVIS and THOMPSON Roto-Matic

Davis & Thompson Company

6411 W. BURNHAM ST., MILWAUKEE 14, WISCONSIN

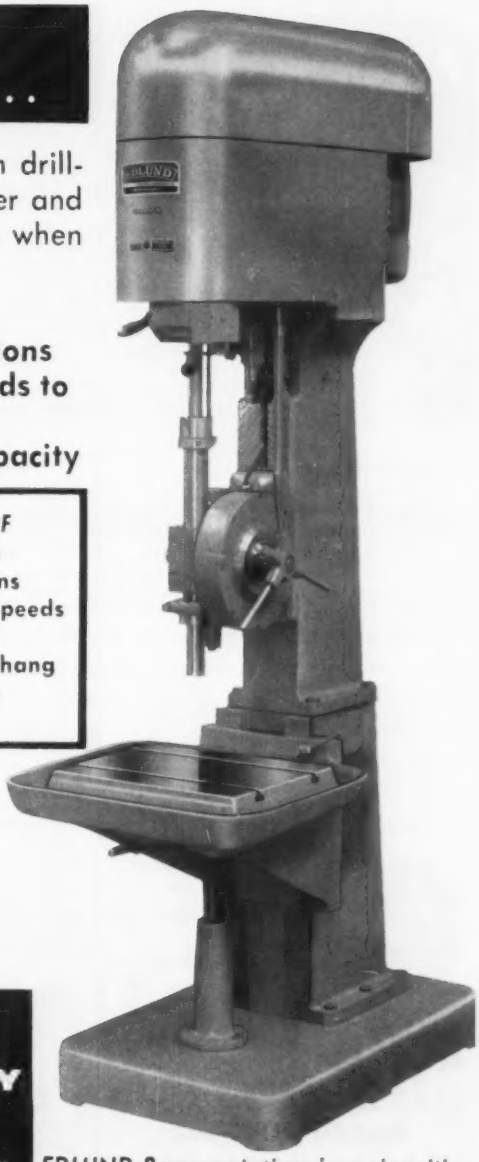
Now! EDLUND "F" SERIES

Infinitely Variable Speed

DRILLING and TAPPING MACHINES

The Right Machine for You . . .
For Your Job . . . For Your Product . . .

Sensitive, medium, or heavy duty production drilling and tapping operations all become easier and faster with lower costs and fewer rejects when Edlund "F" Series machines are used.



Edlund Model 4F
For Heavy Duty Operations
Infinitely Variable Speeds to 2000 RPM
12" Overhang, 1¾" Capacity

Edlund Model 1F	*Edlund Model 2F*
Extreme Sensitivity	For Medium to Heavy Operations
Infinitely Variable Speeds to 10000 RPM	Infinitely Variable Speeds to 3600 RPM
Micrometer Graduated Depth Gage to .001"	8"–12"–15" Overhang
Adjustable Spindle Tension	1¼" Capacity
7" Overhang, ⅜" Capacity	

Infinitely variable spindle speeds, rugged construction, and rapid production features make Edlund "F" Series machines the logical choice for plant expansion and replacement of obsolete equipment.
Write for descriptive Bulletins today.

America's Most Popular Drilling Machine

EDLUND
MACHINERY COMPANY
Cortland, New York
DIVISION—PRECISION CASTINGS CO., INC.
SUBSIDIARY—HARRISBURG STEEL CORPORATION

EDLUND Representatives in major cities

For more information fill in page number on Inquiry Card, on page 229

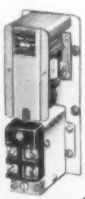
What TIMING RELAYS were most popular at the Chicago Machine Tool Show?

ALLEN-BRADLEY!
51.7% of all timers used were A-B

At the recent Chicago Machine Tool Show, more Allen-Bradley pneumatic timing relays were incorporated in the design of special control panels than all other makes combined —according to a survey of 849 machines. Furthermore, Allen-Bradley led in motor starters, relays, and disconnect switches, too!

Machinery manufacturers prefer Allen-Bradley motor controls because they are long lived . . . consistent in action . . . and above all else, trouble free in operation.

Bulletin 849 Pneumatic Timing Relay—the favorite of machine tool manufacturers because it is consistent and reliable in operation!



A-B Quality

Allen-Bradley Co.
1331 S. First St.
Milwaukee 4, Wis.
In Canada—
Allen-Bradley Canada Ltd.
Galt, Ontario

ALLEN-BRADLEY
QUALITY
MOTOR CONTROL
The Preferred Line

Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.

DRILLING MACHINES, Horizontal Portable

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.

DRILLING MACHINES, Multiple Spindle

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Burg Tool Mfg. Co., Inc., 15001 S. Figueroa St., Gardena, Calif.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14320 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippet Corp., North Tonawanda, N. Y.

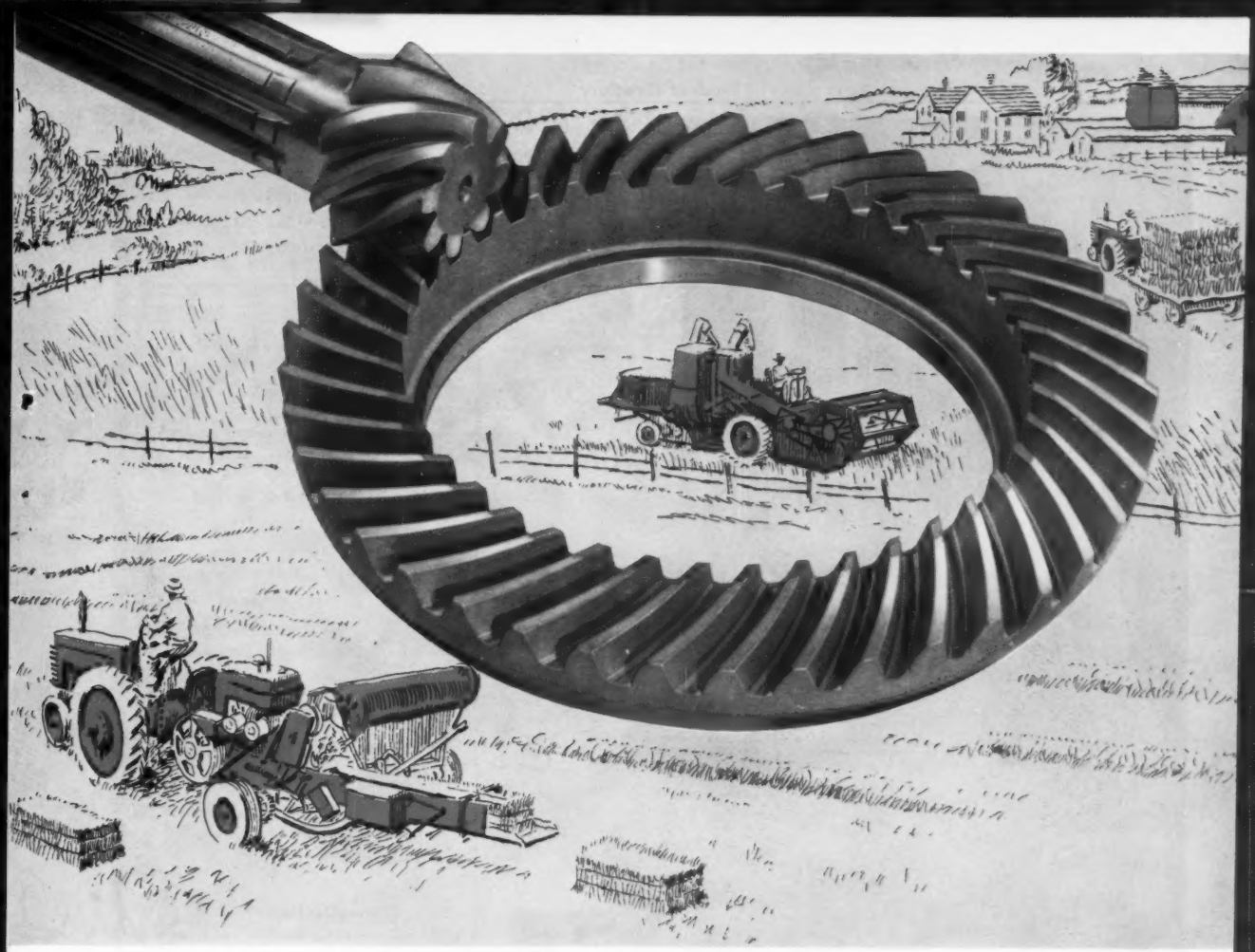
DRILLING MACHINES, Upright

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works, 3817 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

(*Continued on page* 314)



AGRICULTURE-geared to modern production standards

Unlike industrial machinery, farm equipment is exposed to everything that nature can throw at it. Soil is the element in which farm machines work. They're exposed to every fury in the book — heat, cold, snow, ice, dust. They stand idle much of the time, then go to work at an instant's notice, performing perfectly for hundreds of gruelling hours. And they must be built against breakdown that interferes with the critical time schedules of much farm work.

That gears of our manufacture are specified for so many different kinds and makes of farm machinery is proof of their rugged ability to perform reliably under the most rigorous circumstances. Their daily work on America's farms proves their fitness for service in your products or equipment.

Why not write today for further information?

DOUBLE DIAMOND TRADE MARK GEARS

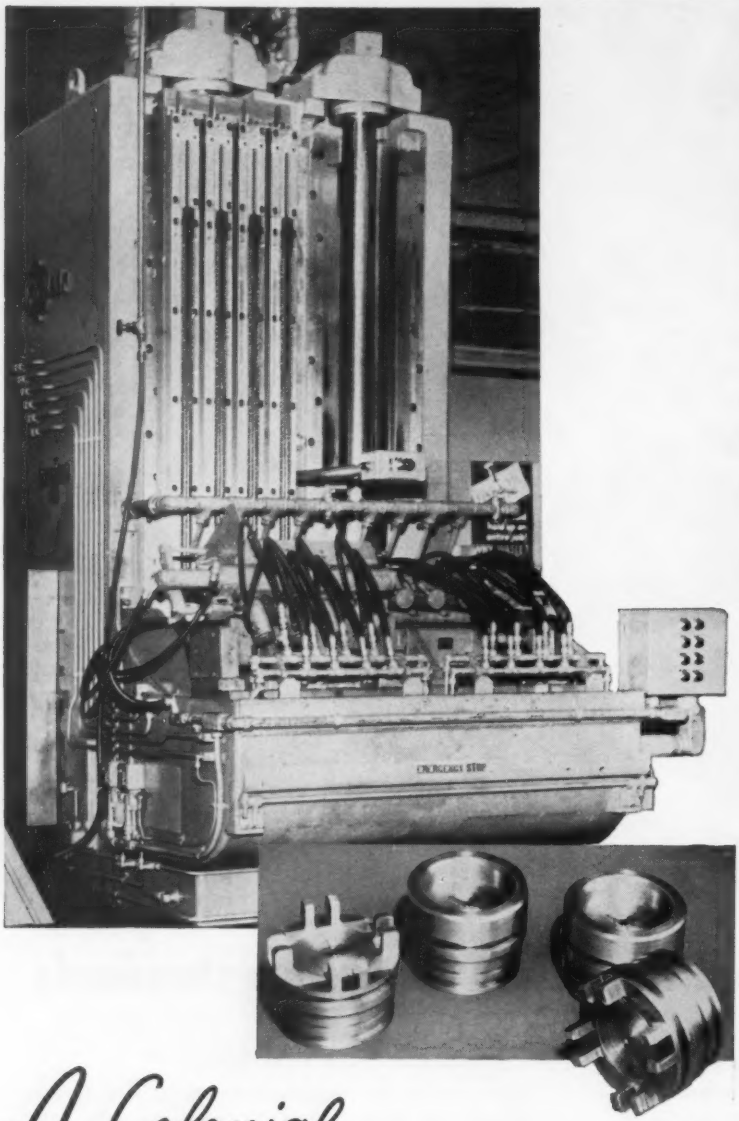
FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

Automotive Gear Works, inc.

ESTABLISHED IN 1914 — RICHMOND, INDIANA

SUBSIDIARY OF EATON MANUFACTURING COMPANY

For more information fill in page number on Inquiry Card, on page 229



A Colonial

UNIFIED BROACHING INSTALLATION

- 480 parts per hour
- 2 passes per part
- 90° index between passes
- Automatic broaching cycle
- 168 pounds of metal broached per hour
- Automatic chip removal
- Colonial dual ram 15-ton 66-inch stroke
- Ask for Colonial dual ram bulletin RT-54

COLONIAL BROACH & MACHINE CO. DETROIT 13, MICH.

DRILLS, Center

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL, Core

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Deep Hole

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Star Cutter Co., Farmington, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati Ohio.
Thor Power Tool Co., Aurora, Illinois.

DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Illinois

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Subland

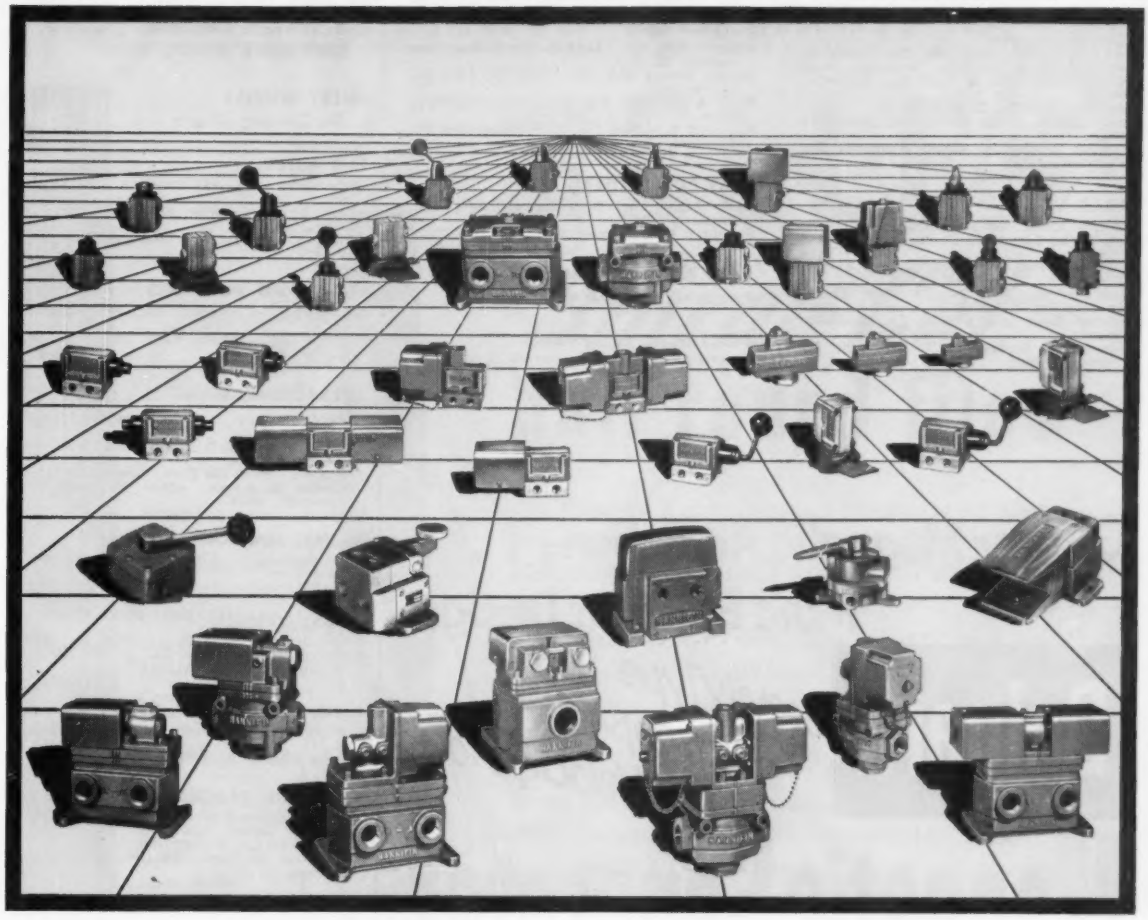
Ace Drill Corp., Odrian, Michigan.
pelier, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.

(*Continued on page* 316)

FOR AIR CYLINDER CONTROL... Manual or Electric



Hannifin is your best valve source

What air control valves do you need, or prefer? Hannifin has all types—for your production lines or the machines you manufacture. They include:

P-M Pilot-Master Valves, solenoid controlled by integral pilot heads (including new-type, dust-tight, splashproof heads that completely meet J.I.C. recommendations). ⅜" to 1¼". 2-way, 3-way and 4-way.

P-M Master Valves. ¾" to 1¼". 2-way, 3-way and 4-way, air operated. For remote control from a wide choice of P-M Pilot Valves.

P-M Direct-Operated Valves. For direct control of small air cylinders. 2-way, 3-way and 4-way. ¼" and ⅜".

Disc Valves. Rotary and sliding reciprocating disc types for hand, foot or electric operation. ⅛" to ¾".

Micrometric Speed Control Valves for micrometer-like speed adjustment through control of exhaust flow.

You can simplify your air control problems by standardizing on Hannifin.

Stock Delivery On All Types

HANNIFIN

MAIL THE COUPON FOR PROMPT ACTION

- ☐ Have Field Engineer call at once
- ☐ Have Field Engineer stop by soon
- ☐ For the present, just send complete Hannifin Control Valves Catalog

Hannifin Corporation, 509 S. Wolf Rd., Des Plaines, Illinois

Name.....*Title*.....

Company.....

Address.....

City.....*Zone*.....*State*.....

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfeld, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Spiral Step Tool Co., Chicago 25, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Ace Drill Corp., Adrian, Michigan.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATORS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

DUST COLLECTORS

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS

Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT

General Electric Co., Schenectady 5, N. Y.

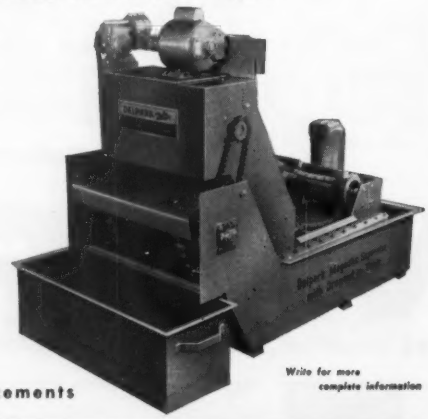
Greater Magnetic Attraction . . .
More Efficient Design

Delpark Gravity Type High Capacity Low Velocity Flow
Magnetic Separator

A new, more efficient design with gravity flow over an enormous, fully concentrated flat magnetic field to give the greatest, most efficient separation of ferrous sludge and abrasives from liquid.

- Greatest concentration of Alnico #5 Permanent Magnets.
- Most powerful magnetic field.
- Magnetic field doubled in width.
- Liquids flow on top of magnetic field — gravity assists magnets.
- Low velocity flow eliminates "washing" and turbidity.
- Depth of liquid held within magnetic field.
- Constant sludge removal by chain driven flights.
- Self Cleaning — Fully Automatic.

Delpark Magnetic Separators are available with adjustable legs, with dragout in tank, with collector tank or without tank. They are also used in combination with the famous Delpark Disposable media filter.



Delpark . . . first in filtration advancements

Write for more complete information

INDUSTRIAL FILTRATION COMPANY LEBANON, INDIANA

EMERY WHEEL DRESSERS

See Dressers, Grinding Wheel

EMERY WHEELS

See Grinding Wheels

END MILLS

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.

ENGRAVING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1110 W. 13th St., Racine, Wis.

EXTRACTORS, Screw

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic

Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Federal Press Co., Elkhart, Ind.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications

American Felt Co., Glenville, Conn.

FILES, Hack

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Oliver Instrment Co., 1410 E. Maumee St., Adrian, Mich.

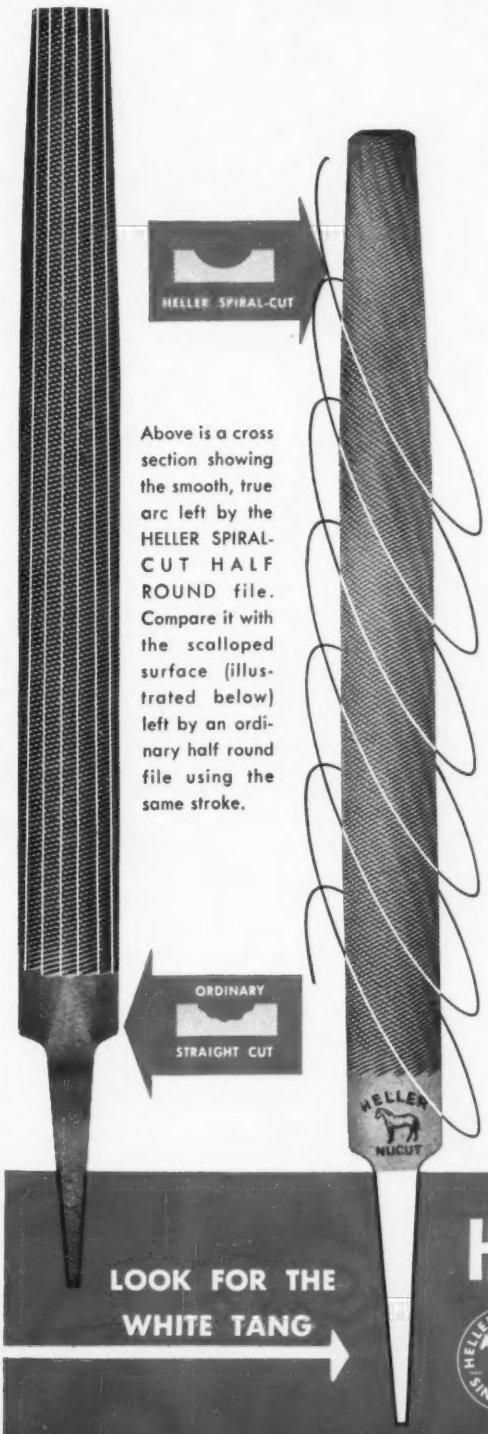
FILTERS, Coolant and Oil

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Commercial Filters Corp., Lebanon, Indiana
Cuno Engineering Corp., Meriden, Conn.
Industrial Filtration Co. (Delpark Corp.), 15 Industrial Ave., Lebanon, Ind.

(*Continued on page* 318)

The Rolling Action is built right in

HELLER
Spiral-Cut
half round files



Above is a cross section showing the smooth, true arc left by the HELLER SPIRAL-CUT HALF ROUND file. Compare it with the scalloped surface (illustrated below) left by an ordinary half round file using the same stroke.

Filing out a concave surface or rounding out a hole is no longer a job restricted to master craftsmen. HELLER SPIRAL-CUT HALF ROUND files eliminate the need for skillful twisting action once so necessary to produce smooth, even work. This rolling action is now designed right into a HELLER SPIRAL-CUT HALF ROUND file.

A straight stroke with an ordinary half round file leaves bumps and ridges unless the user twists it just right. The same straight stroke with a HELLER SPIRAL-CUT HALF ROUND makes a smooth and true-arc surface.

Everyone gets perfect results with this new SPIRAL-CUT, an *exclusive* feature of HELLER HALF ROUND files. This new cutting principle is another of many "firsts" brought out by HELLER in their continuous search for a better file.

these brands always assure HELLER quality

HELLER *American-Swiss*® SWISS PATTERN

VIXEN® MILLED CURVED TOOTH

NUCUT® AMERICAN PATTERN

LOOK FOR THE WHITE TANG

HELLER TOOL CO.

A subsidiary of Simonds Saw and Steel Company

NEWCOMERSTOWN, OHIO

Branches: New York, Detroit, Chicago, Los Angeles

HELLER TOOL CO. SINCE 1856

YOUR *HELLER* DISTRIBUTOR CAN SUPPLY ALL YOUR FILE NEEDS

For more information fill in page number on Inquiry Card, on page 229

FINISHES FOR MACHINE AND METAL PARTS
Lowe Bros. Co., Dayton, Ohio.

FLEXIBLE COUPLINGS
See Couplings, Flexible

FORGINGS, Machines (Upsetting)
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

FORGINGS, Drop
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Federal Press Co., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

FORMING TOOLS or Tool Blanks
Brown & Sharpe Mfg. Co., Providence, R. I.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametel, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

FURNACES, Heat-Treating
Ajax Electric Company, Philadelphia, Pa.
General Electric Co., Schenectady 5, N. Y.
Holcroft and Co., 6545 Epworth Blvd., Detroit 10, Mich.

FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

NOW CUT COST 5410
OF
PRECISION GEAR PRODUCTION

THIS FEATURE: "Independent selection of speed, feed and indexing," sets the Hamilton Precision Small Gear Hobber apart from the field,

AND ENABLES the users of this machine to vary speed and feed to suit the material being machined.

THIS FACT, and a "reserve of accuracy" built into the machine, work spindle and hob spindle runout of less than .0002" as an example,

CONTRIBUTES to more gear precision with no sacrifice of gear production,

OR INCREASED gear production with no sacrifice of gear precision, ... OR BOTH!

Prices and specifications without obligation

ASK FOR FREE BULLETIN 5410

Address
The Hamilton Tool Company
834 South Ninth Street
Hamilton, Ohio

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE

GAGES, Comparator

Ames, B. C., Co., Waltham 54, Mass.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.

GAGES, Depth

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1927, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GAGES, Height

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Surface

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Thread

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R.I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Winter Bros. Co., Rochester, Mich.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

General Electric Co., Schenectady 5, N. Y.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

(*Continued on page* 320)

PORTELVATOR®

The Handy HAMILTON Portable, Elevating Table

A PORTABLE HEIGHT-ADJUSTABLE TABLE
● TRUCK
● WORK BENCH

for
DIE TRANSFER
● MACHINE FEEDING
● ASSEMBLY AT BEST HEIGHT IN BEST LIGHT

LIFTING
● LOWERING
● TRANSPORT
of
SHEETS
PLATES
BARS
TUBES
PIPES
TOOLS
DIES
FIXTURES
● ALL COMPACT HEAVY LOADS

UNOBSTRUCTED PERIMETER
●
WORK FROM ANY SIDE

MORE SERVICE for LESS MONEY than ANY Other Unit of Equipment

43 table surfaces
point support

Recent changes and additions to the line provide greater capacities, new flexibility, many bonus features.

Write for NEW, FREE Bulletin P-5604

Address THE HAMILTON TOOL COMPANY,
834 South Ninth Street, Hamilton, Ohio

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE

5604

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

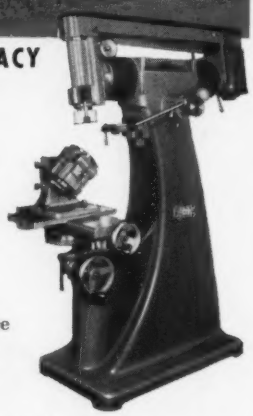
GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

IN MOST SET-UPS

THE WORK IS HELD RIGID...
THE GRINDING WHEEL TRAVERSES...

PROVIDING
• EXTREME ACCURACY
• SIMPLICITY
• ECONOMY



THE Oliver ACE CUTTER GRINDER

Look into the advantages of the Oliver Ace . . . Replace outdated methods and save. With the Oliver Ace, two fixtures handle a complete range of tool and cutter grinding. Two models are provided . . . Heavy-Duty Model illustrated for tungsten-carbide cutters and tools, and Standard Model for high speed and light duty carbide grinding. The Oliver is better for sharpening:

★ SIDE AND FACE CUTTERS
★ FACE MILLS AND END MILLS
★ SLAB MILL CUTTERS
★ ANGLE CUTTERS
★ COUNTERBORES
★ COUNTERSINKS
★ REAMERS
★ SPOT FACING CUTTERS

THE OLIVER ACE WILL HANDLE NEARLY ALL CUTTER GRINDING REQUIREMENTS. EXCELLENT FOR THE SHARPENING OF TUNGSTEN-CARBIDE TIPPED CIRCULAR WOOD SAWS.

Write for Brochure . . . Complete Details

Oliver INSTRUMENT • COMPANY

1410 EAST MAUMEE OLIVER OF ADRIAN ADRIAN, MICHIGAN

FACE MILL GRINDERS • AUTOMATIC DRILL GRINDERS • DIE MAKING MACHINES
TOOL & CUTTER GRINDERS • DRILL POINT THINNERS • TEMPLATE TOOL GRINDERS

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrell-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield Vt. (Straight and Hourglass Types).
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George, Co., Inc., 200 Lafayete St., New York 12, N. Y.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Van Norman Co., Springfiela, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

(Continued on page 322)

TWO-BOLT CLAMPING adjusts easily, positively from 0" to 7" in height, and swing arc 2" each side of center.

HEAVY-DUTY CYLINDER with extra heavy wall, tie rods and piston construction for longer life.

RIGID STEEL COLUMN and rugged cylinder bracket are accurately machined for precision work.

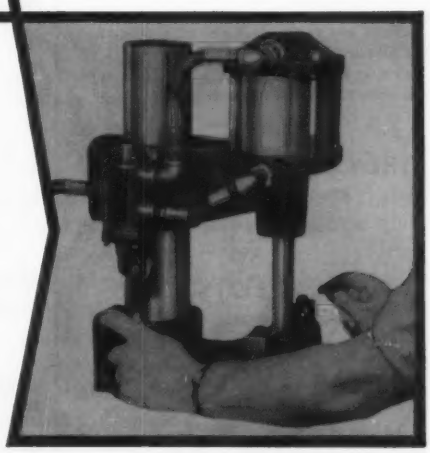
HEAVY, RUGGED BASE forms sturdy foundation for large machined-surface table area.

SPECIAL RECESS IN TABLE provides for punch-through operations.

NEW SCHRADER AIR PRESS

It's compact and power packed!

It stamps, coins, broaches, rivets, stakes, presses, shapes, bends, assembles—*many other uses!*



Modern "muscles" of compressed air never tire . . . get more work done at less cost!

This modern Air Press has unlimited possibilities for speed, power, positive performance. Available as single acting for impact jobs; double acting for squeeze and power withdrawals. It requires minimum space, next to no maintenance, is extremely versatile in adapting to operating controls. Can't be beat for low cost practicality.

Important feature: Control and speed of the extra heavy cylinder and ram can be varied as necessary, by using standard Schrader Air Control Accessories that adjust in seconds.

Write for Catalog data describing Air Press fully—including variety of controls and accessories. Your Schrader supplier has the Air Press you need!

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
470 Vanderbilt Avenue, Brooklyn 38, N. Y.

Schrader®
ESTABLISHED IN 1844

LEADERS IN AIR CONTROL SINCE 1844

The Good in our slogan

F. J. Sorensen

CHAIRMAN, THE CINCINNATI GEAR CO.

Our slogan, "Gears . . . Good Gears Only," seems almost unpretentious by modern standards. In this day of soaring advertising superlatives and grandiose claims of product superiority, we feel it sounds a little old-fashioned—and that's just the way we want it.

There is little about our production today, from a technological stand-point, that resembles our operations of even a few decades ago. New modern machinery in an ultra-modern plant has enabled us to offer a degree of precision and efficiency undreamed-of in our fathers' time. But, while we've striven to be second to none in utilizing the advancements made possible through technological progress, we've also attempted to retain something of the old-fashioned craftsmanship and pride of workmanship that is all too often lost in the modern shuffle of mass production.

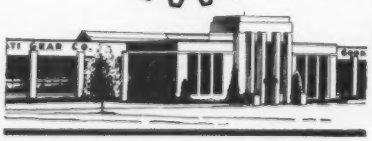
We specialize in just one thing: the manufacture of the best custom gears that can be produced. To our modern production techniques we add this old-fashioned ingredient of craftsmanship; the result is just what is promised in our simple slogan: we produce *good* gears, and good gears *only*. This simple claim is backed by our reputation — we *deliver* good gears only. It's a claim and a reputation we intend to perpetuate for many years to come.

THE CINCINNATI GEAR CO.

CINCINNATI 27, OHIO

"Gears—Good Gears Only"

CINTI



GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Wks., 1309 So. Cicero Ave., Chicago 50, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

GEARS, Rawhide and Non-Metallic

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

GEARS, Stamped

Winzeler Mfg. & Tool Co., 1712 W. Arcade Pl., Chicago 12, Ill.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

GRADUATING MACHINES

Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Machines, Carbide Tool

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Madison-Kipp Corp., Madison, Wis.
Thor Power Tool Co., Aurora, Illinois.

GRINDERS, Portable Electric and Toolpost

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thor Power Tool Co., Aurora, Illinois.

GRINDING FIXTURES

Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sterling Grinding Wheel Co., Tiffin, Ohio
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

GRINDING MACHINES, Broach

Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

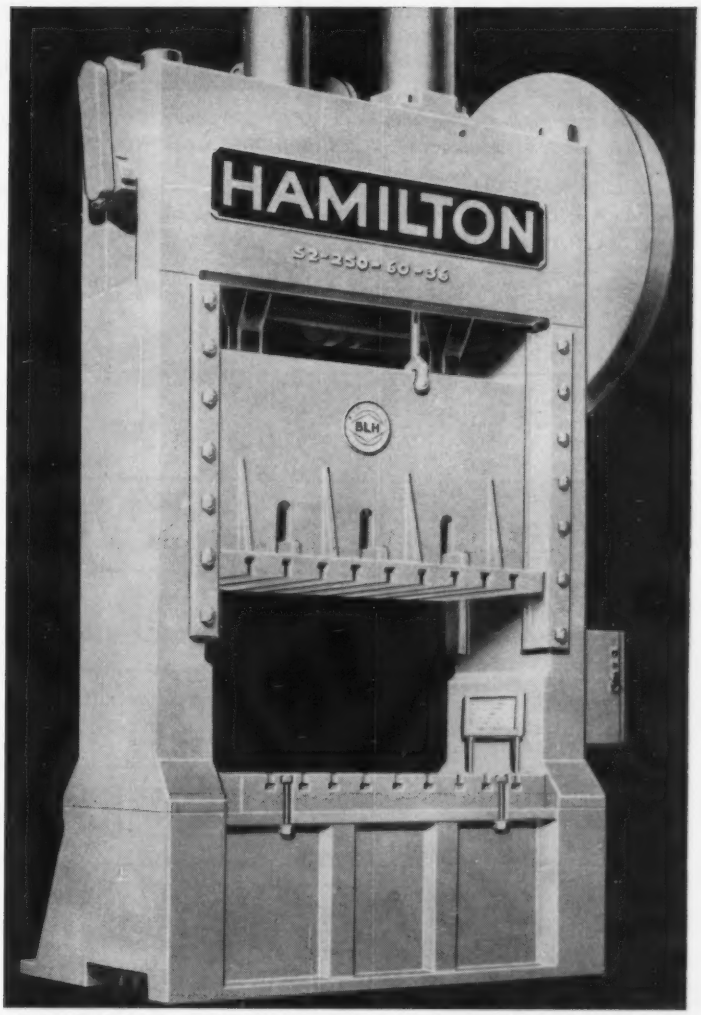
GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

(*Continued on page* 324)

News from Hamilton!

100 to 300 ton press line sets new standards



Here's Hamilton's brand new high-speed 250-ton, double-crank press with 60" x 36" bed and slide

For the first time in the industry, Hamilton gives you 100 to 300 ton presses built to meet exacting automotive production standards . . . standards pioneered in the automotive field through more than thirty years of Hamilton press leadership.

Every one of these 2-point, single acting, straight-side, double-crank presses is a brand new design. Each is engineered for constant top-speed, top-quality production—without profit-robbing downtime. Each is built for complete operating flexibility. Here are just a few of Hamilton's built-in extras that mean more operating profit for *you:*

- rugged welded steel construction
- mechanically interlocked air clutch and brake
- barrel-type motorized slide adjustment
- automatic lubrication
- pneumatic flywheel brake
- die lights
- die cushions
- pneumatic counterbalances
- interlocked electrical clutch control

Exact specifications are adjustable to your individual requirements. Special electrical controls are available to meet particular electrical standards.

It will mean money in your pocket to find out today how these all-new Hamilton presses can help you turn out high quality stampings fast . . . without costly production downtime. Get the full story on these new standards for 100 to 300 ton presses . . . from Hamilton Division, BLH Corporation, Hamilton, Ohio.

HAMILTON DIVISION
BALDWIN-LIMA-HAMILTON
DIVISIONS: Austin-Western • Eddystone • Electronics & Instrumentation • Lima • Loewy-Hydropress • Madsen • Pelton • Standard Steel Works

For more information fill in page number on Inquiry Card, on page 229

GRINDING MACHINES, Carbide Tool

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GRINDING MACHINES, Centerless

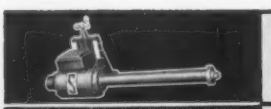
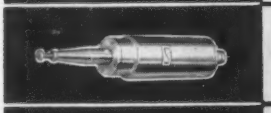
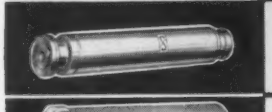
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Van Norman Co., Springfield, Mass.

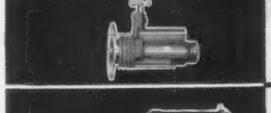
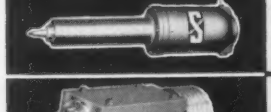
GRINDING MACHINES, Chucking

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

WHEREVER SPINDLES ARE NEEDED, STANDARD SUPPLIES THE FINEST!

SINCE 1912

HALLMARK OF METALWORKING THROUGHOUT THE WORLD

the STANDARD electrical tool co.

MAKERS OF 800 DIFFERENT SPINDLES...AND READY TO DESIGN 1000 MORE FOR INDUSTRY'S NEEDS!

WRITE TODAY: SUPER PRECISION SPINDLE DIVISION

2500 RIVER ROAD • CINCINNATI 4, OHIO

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Drill

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDING MACHINES, Face

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobbs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.

(*Continued on page* 326)

New Literature AVAILABLE

Write us on your Company Letterhead...

BARDONS & OLIVER, INC.

1135 WEST 9TH STREET • CLEVELAND 13, OHIO

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2448-90 River Rd., Cincinnati, Ohio.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Moore Special Tool Co. Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney Co., Inc., West Hartford, Conn.

GRINDING MACHINES, Knife and Shear Blade

Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Piston Ring

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Sheffield Corp., 721 Springfield St. Dayton 1, Ohio.

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Radial

Consolidated Mch. Tool Corp., Rochester, N. Y.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.

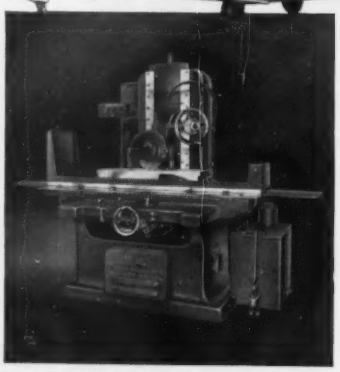
GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

(*Continued on page* 328)

FOUND WHERE FINE BUSINESS MACHINES ARE "BORN"

GRAND RAPIDS GRINDERS



INTERNATIONAL BUSINESS MACHINES

Producing an intricate business machine requires exceptional toolroom precision. That's why these manufacturers use Grand Rapids Grinders . . . engineered to achieve extraordinary grinding precision at cost-cutting speed.

Model No. 55, at right, offers such features as one-piece column and base for permanent, vibrationless alignment, wheel head with powered rapid vertical travel, hydraulically actuated cross feed and longitudinal travel table. And it's the fastest grinder of its size and type, with a variable table speed up to 125 fpm!

Whether you make business machines or bulldozers, you can count on Grand Rapids Grinders for maximum toolroom precision.

SMITH CORONA
COMPTOMETER
REMINGTON RAND
UNDERWOOD
R. C. ALLEN

GALLMEYER & LIVINGSTON

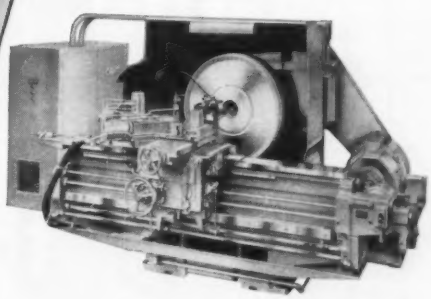
GRAND RAPIDS NO. 55 HYDRAULIC FEED SURFACE GRINDER. Table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head is 18". Preloaded ball bearing spindle greased for life. Spindle speed 1825 and 2500 rpm.

A note on your letterhead will bring complete details.

GALLMEYER & LIVINGSTON COMPANY
305 Straight Ave., S.W., Grand Rapids, Michigan

There's only one T lathe

. . . designed and perfected by Lodge & Shipley for ANY large diameter, short length work



As the use of Lodge & Shipley T Lathes spreads over an ever-widening variety of applications, the extreme versatility of this lathe becomes more apparent. Wherever large diameter, short length workpieces must be faced, turned or bored, the T Lathe proves notable accuracy and productivity.

Evaluate your own work of this nature, work that may now be machined on oversize lathes, boring mills or other makeshift set-ups. Transfer to a T Lathe for faster, lower cost production and release the other machines to more suitable uses.

T Lathes are far faster, more sensitive and much more accessible. They take less floor space and cost less than comparable machines. Get the facts . . . write for Bulletin 215. **The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.**

There are 8 types of T Lathes to fit every production requirement in various combinations of:

. . . straight and angular facing, turning and boring, and

. . . contour facing on both sides of center, contour turning and boring.

Lodge & Shipley

. . . . your **LODGE**-*ical choice!*

For more information fill in page number on Inquiry Card, on page 229

GRINDING MACHINES, Thread
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

GRINDING MACHINES, Universal
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frauenthal Div., Kaydon Eng. Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDING MACHINES, Worm
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING WHEELS
Besly-Welles Corp. (Abrasive Div.), 20 N. Wacker Drive, Chicago 6, Ill.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley St., Bridesburg, Philadelphia, Pa.
Sterling Grinding Wheel Co., Tiffin, Ohio

GROOVING TOOLS, Internal
Spiral Step Tool Co., Chicago 25, Ill.
Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

HAMMERS, Forging Air
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

HAMMERS, Pneumatic
Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

HAMMERS, Portable Electric
Thor Power Tool Co., Aurora, Illinois

HAMMERS, Power
Chambersburg Engrg. Co., Chambersburg, Pa.

HAMMERS, Shaft
Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft
Chambersburg Engrg. Co., Chambersburg, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HARDENING EQUIPMENT
General Electric Co., Schenectady, N. Y.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

HARDNESS TESTING INSTRUMENTS
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave., and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HOBBING MACHINES
See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lees-Bradner Co., Cleveland, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.

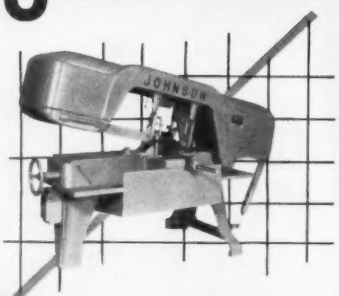
HOIST HOOKS
Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page* 330)

Time Study your Metal Cutting... and You'll Get a Johnson

MODEL J

Increase your output with a big, rugged Johnson Model J (Heavy Duty) Saw. Cuts anything in your stockpile . . . 10" rounds, 18" flats, heavy structurals and odd shaped pieces. Variable speed. Optional cooling attachment permits continuous cutting on production jobs.



MODEL B

Stop losing man hours on slow, inefficient metal cutting machines. Specify a Johnson Model B (wet or dry) Saw for top production. Variable speed. Saws 5" rounds, 10" flats, odd and irregular shapes too. Can be caster equipped for portability.

MODEL M

End slow, inefficient hand cutting in your plant. Just wheel the Johnson Model M "Mobile" up to the job. Saw anywhere. Cuts 5" rounds, 10" flats, structural steel, pipes, conduits, angle iron, etc. Carries its own extra blade supply.

Johnson
MANUFACTURING CORPORATION
1016 Barnes Street
Albion, Michigan

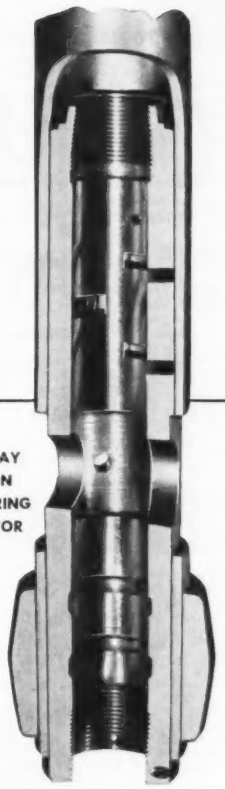
• • • • ***WRITE TODAY*** **for Your copy of the big, illustrated Johnson Saw catalog. It's yours for the asking!**

Eastern Distributor	*Mid-Western Distributor*	*Western Distributor*
R. J. R. KELLY CO.	W. Q. LUNDMARK	HASTINGS DISTRIBUTORS
Hale Bldg., 51 Main St.	75 N. Broadway	1605 Solano Avenue
East Orange, N. J.	Des Plaines, Illinois	Berkeley, California

MICROHONING*

with self-dressing abrasives generates consistent *Functional Surface Finishes*

Microhoning, the low-velocity abrading process consistently produces part after part exactly to your specified surface finish requirements, because the abrasive grits always remain sharp.



CUTAWAY SECTION OF STEERING ACTUATOR

Monroe Auto Equipment Co. designed its power steering unit to withstand rugged use while maintaining sensitive control. In the final processing of the hydraulic steering actuator, Monroe chose Microhoning to obtain diametric accuracy, consistent finish and to generate geometric precision.

The rough and finish Microhoning operations removed .005″ stock from an interrupted bore 1.125″ in diameter and 6⅜″ long.

MATERIAL AND HARDNESS: SAE 1118 steel, Rockwell 45-50C

TOLERANCES: size—.0003″
roundness and taper—.0001″

FINISH: 25 microinches or less

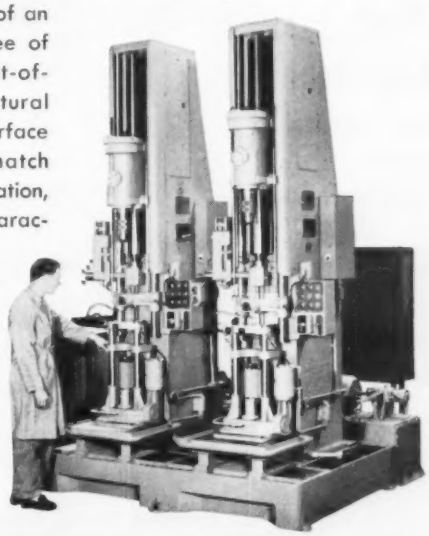
CYCLE: rough Microhoning—35 to 40 seconds
finish Microhoning—15 to 20 seconds

MACHINE: Double-column Model 740 Hydrohoner

SELF DRESSING ACTION OF THE ABRASIVES . . . is accomplished by the rotation and reciprocation of the Microhoning tool—the combined motion continuously changes the direction of force on the abrasive grits and keeps them dressed.

EFFICIENT STOCK REMOVAL . . . results from the many sharp-cutting grits acting simultaneously over a wide area of work surface. In this manner, the effect of heat is also minimized. Of all production processes, Microhoning least disturbs the sub-surface structure of the work.

FUNCTIONAL SURFACE CHARACTERISTICS . . . are obtained in one uninterrupted cycle. Microhoning generates accuracy within millionths of an inch . . . surfaces free of waviness, taper, out-of-roundness and structural stresses . . . uniform surface finish and a cross-hatch pattern for best lubrication, sealing and wear characteristics.



PRECISION PRODUCTION THROUGH MICROHONING
MICRO MATIC
TRADE MARK

For more details on this application write for CROSS-HATCH Vol. 8, No. 1

*MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

For more information fill in page number on Inquiry Card, on page 229

HOISTING AND CONVEYING EQUIPMENT
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Illinois

HOISTS, Chain, Etc.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric
Philadelphia Gear Works Inc., Erie Ave. and G St., Philadelphia, Pa.

HONING MACHINES, External
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HONING MACHINES, Internal (Cylinder)
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Fulmer, C. Allen Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detriot 7, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HONING STONES
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Fulmer, C. Allen Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HONING TOOLS AND FIXTURES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HOSE, Leather, Rubber, Metallic, Etc.
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

HYDRAULIC MACHINERY
Tools and equipment
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS
Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.
Barnes, John S. Corp., Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

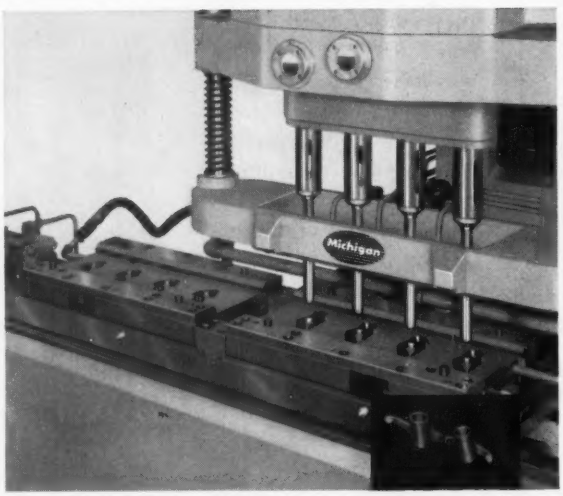
INDEXING AND SPACING EQUIPMENT
Amelco, Inc., 2040 Colorado Ave., Santa Monica, Calif.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Michigan Drill Head Co., Detroit 34, Mich.
Micro-Positioner Corp., 716 Wilshire Blvd., Santa Monica, Calif.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

(Continued on page 332)

Finish reams 1200 rocker arms per hour

Most Important

NO FURTHER SUPER FINISHING OF THE ROCKER ARM SHAFT HOLE IS NECESSARY



It's a 2-station Automatic Shuttle Fixture mounted on our Standard Hydro 5 Drill Press. Interchangeable nesting plates, for any size or shape rocker arm, will fit this machine.

We also invite your inquiries as to our line of tapping units, and index tables—both manual and automatic—catalog sent on request.

Michigan **DRILL HEAD CO.** Detroit 34, Michigan

engineers and manufacturers of production machines and drilling equipment

this 140-TON horizontal milling machine

There's never been one like it before!

Just a press of a button puts this mighty Schiess into action. A 25-ft. high column moves smoothly along 45-ft. long bedways. Never a vibration—no chatter—even at maximum transversal loads! The new Schiess design of the spindle heads has eliminated this!

THE MILLING OPERATION. A huge tungsten-carbide cutter in a 14¼" spindle goes to work on the stock. And performs its operation with a consistent accuracy—a surface-finish count—never before obtainable on such a big fellow.

THE BORING OPERATION. Another press of a button! Another spindle goes to work—bores a 79" depth in one cut—or a total depth of 118". Boring and milling spindles are provided with 36 speeds of which the top 12 are V-belt transmitted. Rapid traverse, feeds and manual controls of the two spindles are completely independent.

That this mighty machine has tremendous productive capacity is self-evident. And its productivity goes far beyond conventional milling and boring. Schiess attachments increase its scope to taper-milling, thread-cutting, copying and, in certain instances, copying in 3 dimensions. It's a time saver, too. Can go from feed to rapid traverse immediately, without complicated adjustments.

The Schiess Model FB 36/22.5 Horizontal Milling and Boring Machine is a product of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess Engineer will be happy to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on all five FB models.

also bores and turns

Face milling entire side of 38' x 14' press frame on Schiess Model FB 36/22.5

Engineering Division
AMERICAN SCHIESS CORPORATION
1232 Penn Avenue, Pittsburgh 22, Pennsylvania

Sole Distributor
KURT ORBAN COMPANY, INC.
34 Exchange Place, Jersey City, N. J.

South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Zagar Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

INDICATORS, Dial

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S. Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

INTENSIFIERS, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

15,000 THREADED NAILS per hour with HARTFORD Thread Rollers . . . *Automatically*

USER REPORT:

From Chas. F. Baker & Co., Framingham, Mass., John P. Hillberg, General Manager: "Hartford Special machines have been more than satisfactory on production and especially economical on up-keep."

QUICK SPECS

Nail Diam. Capacity—.080" to .169"
Thread Length Capacity—⅛" to 2"
Production Rate—250 pcs. per min.
Floor Space Required 4' x 5'
Machine Size—42" x 26" x 52".

Nail down the answer to your nail and screw threading problem. Check the specs.

For detailed information write for Bulletin TR-102.

Machine Tool Accessories Division
THE HARTFORD SPECIAL MACHINERY CO.
2906 Homestead Ave., Hartford, Conn.

HARTFORD *Special*

JACKS, Planer

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

JIG BORER

See Boring Machines, Jig

JIGS AND FIXTURES

Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homstead Ave., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

JOINTS

See Fittings, Hydraulic, Pneumatic, Etc.

KEYSEATERS

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

KNURL HOLDERS

Brown & Sharpe Mfg. Co., Providence, R. I.

KNURLING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES

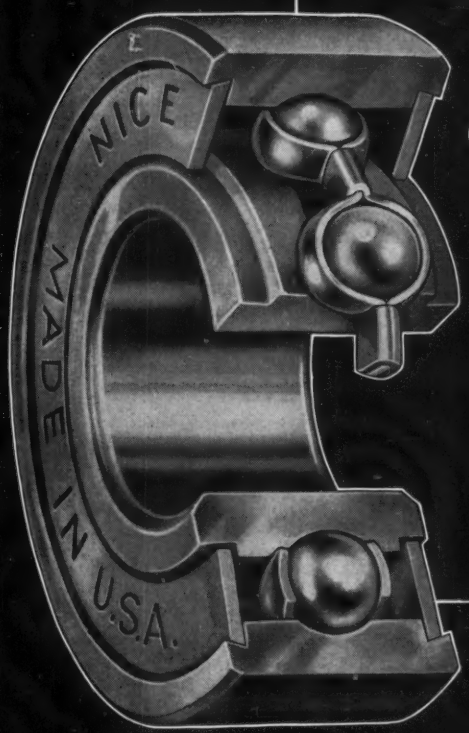
Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.

LAPPING PLATES, Hand

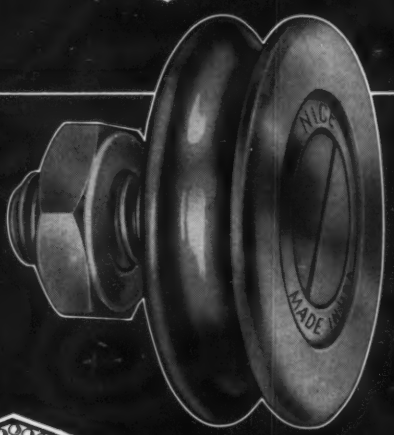
Crane Packing Co., 1800 Cuyler Ave., Chicago.

(*Continued on page* 334)

Have you given NICE a chance to Quote?



STANDARD and SPECIAL BALL BEARINGS
Since 1902



WRITE FOR
CATALOG NO. 150

NICE

NICE BALL BEARING COMPANY
NICETOWN · PHILADELPHIA · PENNSYLVANIA

LATHE AND GRINDING DOGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

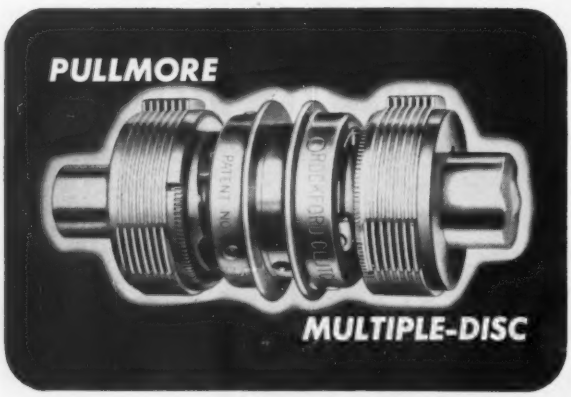
LATHE ATTACHMENTS

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sundstrand Mch. Tool Co., 2431 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Automatic

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfeld, Vt.
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Senaca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

ROCKFORD



HIGH-RATIO LEVER DESIGN

COMPACT DESIGN
HIGH TORQUE
HIGH-RATIO LEVERS *
POSITIVE NEUTRAL
PRECISION BUILT
LONG WEAR LIFE
EASY ADJUSTMENT

*High-ratio operating levers give PULLMORE clutches powerful engagement with slight axial pressure and short movement of the shifter spool; consequently operation is quick and easy. Declutching is equally fast and positive. The shifter spool has an extra deep slot which is hardened and ground. This prolongs the life of the clutch, reduces wear on the shifter fork and holds run-out to a minimum.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD CLUTCH DIVISION BORG-WARNER
▲ 410 Catherine Street, Rockford, Illinois, U.S.A. ▲

CLUTCHES

LATHES, Axle

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg, Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Levin, Louis & Son, Los Angeles 21, Calif.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25 Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Duplicating

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

(Continued on page 336)

BURGMASTER®

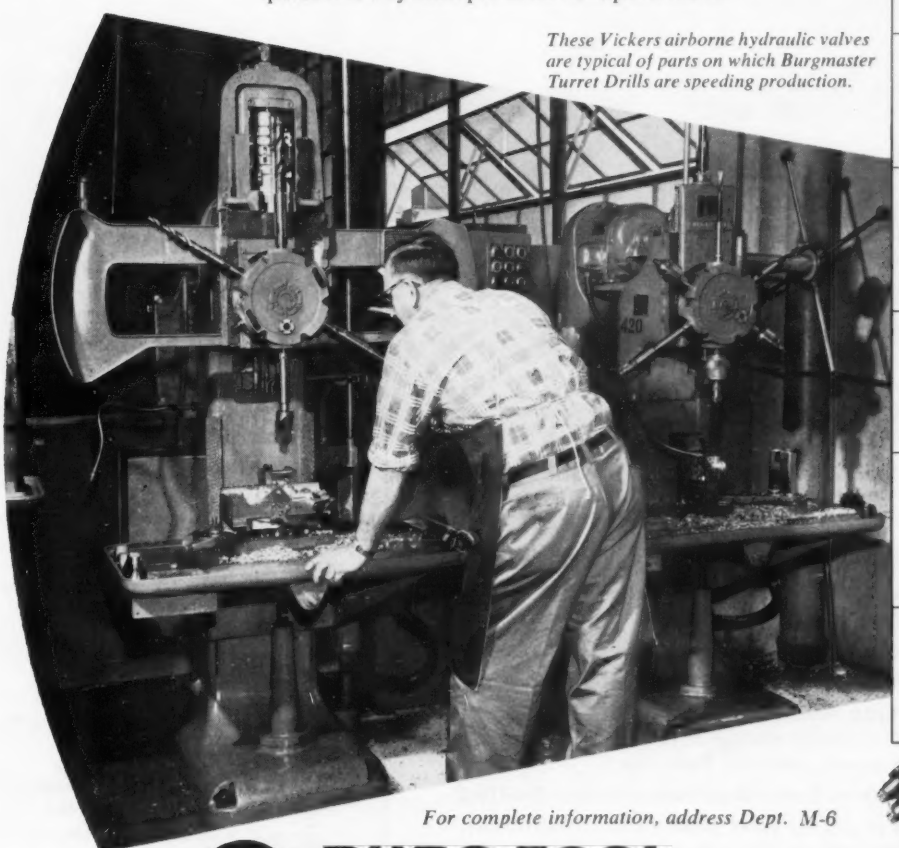
POWER INDEXING

Turret Drills

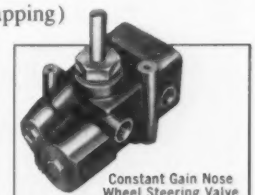
step up AN porting operation 25% at Vickers, Incorporated

Vickers, Inc., Div. of Sperry Rand Corp., El Segundo, Calif., manufacturers of hydraulic equipment, use both hand-operated and automatic hydraulic Burgmaster Turret Drills in their production lines. The company states that the AN porting operation on hydraulic valves has been stepped up approximately 25% over the old single spindle method. Vickers have found that the Burgmasters maintain sizes accurately, are easily set up, and perform multiple operations (drilling, reaming, counterboring, tapping) in one set-up, with one operator—automatically.

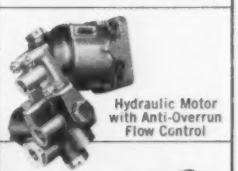
Automatic hydraulic Burgmasters (6 and 8 spindle models) feature skip indexing, automatic cycling and infinitely variable preselective feeds. All models (including the 6 spindle manuals) provide power indexing, pre-selective spindle speeds and very close pre-selective depth control.



These Vickers airborne hydraulic valves are typical of parts on which Burgmaster Turret Drills are speeding production.



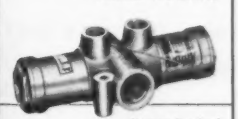
Constant Gain Nose Wheel Steering Valve



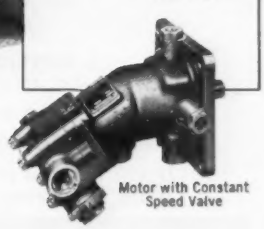
Hydraulic Motor with Anti-Overrun Flow Control

Flow-Sensitive Pressure Regulator

Relief Valve with Thermal Protection



Power Control Flow Regulator



Motor with Constant Speed Valve

For complete information, address Dept. M-6

BURG TOOL
Manufacturing Company, Inc.
15001 South Figueroa Street, Gardena, California
Sales Office: New York · Chicago · San Francisco

LATHES, Engine and Toolroom

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Oh.o.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gap

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland [illegible] Ohio

LATHES, Gun

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Machine Tool Co., Springfield, Ohio.

LATHES, Hollow Spindle

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

See Lathes, Engine and Toolroom

LATHES, Turret

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc. (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Potter & Johnston Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co. 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.

LAYOUT FLUID

Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS

Bullard Co., Brewster St., Bridgeport 2, Conn.
Starrett, The L. S., Co., Athol, Mass.

LIGHTS, Indicator

Dialight Corporation, 60 Stewart Ave., Brooklyn 37, N. Y.

LOCATORS, for Jig Borers

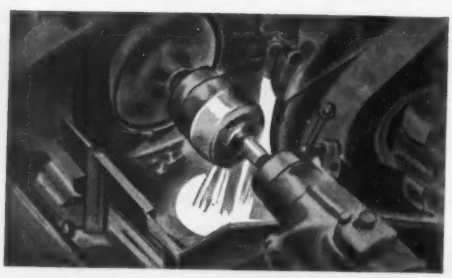
Arter Grinding Machine Co., 15 Sagamore Rd., Worcester 5, Mass.

LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
International Chemical Co., 2628 N. Mascher St., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.

(*Continued on page* 338)

Cutting or Grinding ALUMINUM?



Use INTERNATIONAL 131-A

The ONE *Coolant that Gives You*

All of These Advantages:

- **NO METAL DISCOLORATION**
  Does not stain aluminum or its alloys—regardless of concentration used.
- **INCREASES TOOL LIFE**
  Prevents welding of chips to tool.
- **CUTS WHEEL DRESSINGS**
  Retards loading of grinding dust on wheel.
- **DOES NOT REACT WITH ALUMINUM DUST**
  No contamination—sanitary in every way.
- **NO SKIN IRRITATION**
  Operators approve International 131-A.
- **SUPERIOR FINISH**
  Profilometer readings of two micro-inches or less are readily obtained. Fewer rejects.

International 131-A Gives Outstanding Results on Stainless Steel Too!

It will pay you to get the facts about International 131-A. Write for information.

INTERNATIONAL CHEMICAL COMPANY
Specialists in Cleaners and Coolants for Industry
2628 N. Mascher Street • Philadelphia 33, Pa.

Qualifications	—Trained assembly engineer. Familiar with all present-day fastening techniques. In daily contact with engineering, production and purchasing departments.
Experience	—Can draw on the experience of more than a million applications. Successful record of pointing the way to assembly savings (often up to 50%) in 7 out of 10 cases.
Opportunity Wanted	—A chance to study your product (preferably in the design stage) and to make recommendations for speeding assembly, reducing spoilage, improving strength and reducing costs by means of the fast, effective P-K method.
"Tools"	—Parker-Kalon, the only complete line of Self-tapping Screws. The right "tool" fitted to every job.
Remarks	—No cost or obligation. For details, call your local Parker-Kalon distributor.

PARKER-KALON® *fasteners*

Parker-Kalon Division, General American Transportation Corporation—Clifton, New Jersey
Sold Everywhere Through Leading Industrial Distributors. Warehouse in Chicago, Illinois

For more information fill in page number on Inquiry Card, on page 229

Socony Mobil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, etc.

MAGNETIC BASES FOR INDICATORS

du Mont Corp., Greenfield, Mass.

MANDRELS

See Arbors and Mandrels

MARKING MACHINES AND DEVICES

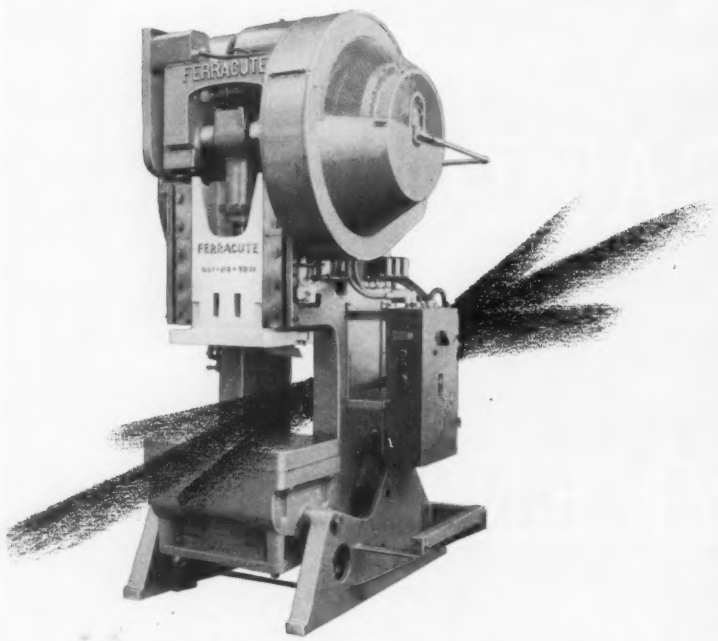
Acromark Co., 9-11 Morrell St., Elizabeth 4, N. J.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.

MASKS, PAINTING

Conforming Matrix Corp., 342 Toledo Factories Bldg., Toledo 2, Ohio.

MATERIALS HANDLING TRUCKS

Automatic Transportation Co., 133 W. 87th St., Chicago 20, Ill.



110-Ton Model

● AIR CLUTCH ● INTERCONNECTED BRAKE ● BOX TYPE RAM ●
AIR COUNTER BALANCE ● DIE LIGHTING ● PNEUMATIC DIE CUSHION

ON *FERRACUTE*

Open-Back Inclinables

Air clutch standard on models 110-ton, 150-ton, 200-ton. Air clutch optional on models 32-ton, 43-ton, 56-ton, 70-ton, 88-ton. Box type ram available on models 110-ton, 150-ton, 200-ton. Write for complete specification sheets on these high-production, low-cost FERRACUTE OPEN-BACK INCLINABLE PRESSES.

FERRACUTE MACHINE COMPANY
Manufacturers of Power Presses, Press Brakes and Special Machinery
BRIDGETON, NEW JERSEY, U.S.A.

FERRACUTE
Since 1863

MEASURING MACHINES AND INSTRUMENTS, Precision

Crane Packing Co., 1800 Cuyler Ave., Chicago.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Starrett, The L. S. Co., Athol, Mass.

METAL, Bearings

See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METAL DISINTEGRATOR

Elox Corp., Royal Oak, Mich.

METERS

See Recording Instruments

MICROMETERS

Ames, B. C., Co. (Dial) Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

MICROSCOPES, Toolmakers

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., Milwaukee, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

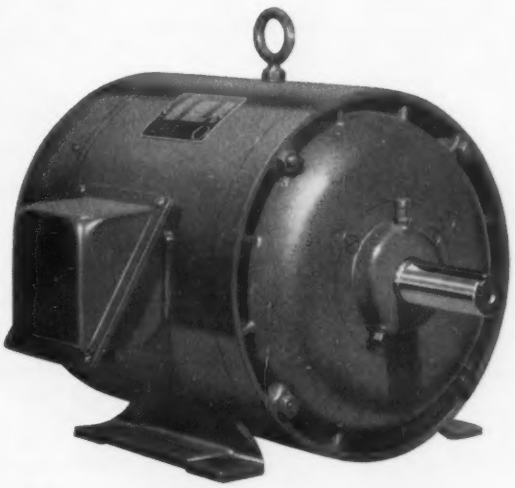
Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.

(*Continued on page* 340)

PLUS values in power

the SMOOTH STREAMLINED CONTOURS

of HOWELL series one hundred motors . . .



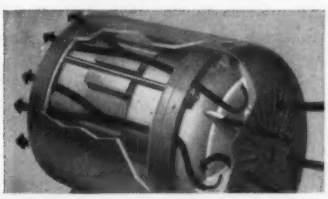
LOOK BETTER ON YOUR MACHINES,

HAVE NO DUST CATCHING FINS OR OFFSETS

Designed for the Age of Automation, these sleek, new Howell Series 100 Motors add a plus value in modern good looks to your machines and equipment. Their streamlined contours are functional, too — no fins, ribs or unnecessary offsets on frames or end plates to collect dust deposits. Results: a motor that never loses its cool-running efficiency, good appearance that's easy to maintain, and a minimum of fire hazard from dust accumulations.

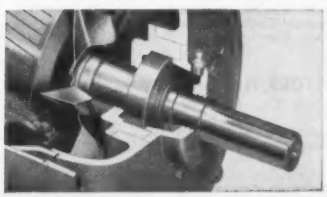
When you are selecting power units for your machines, why not consider superior good looks — they cost no more! Specify Howell Series 100 to get this and all the other plus values of today's most modern industrial motors.

GET THE PLUS values THAT COUNT.. specify HOWELL series 100 motors



heat-source ventilation licks tough applications

Wide stator slots provide 50% more contact between fan-driven air and stator laminations, main source of motor heat. To get an extra cool running motor, specify Series 100!



bearing protection doubled for longer motor life

On Series 100 TEFC motors, bearing cartridges seal out dust and dirt, even when motor is disassembled for servicing. You can't buy better assurance of motor dependability.

steel frames and feet— greater strength, less weight

Unlike cast iron, Howell's steel frames and feet won't crack under the stress of accidental mishandling or the excessive tightening of mounting bolts. Another plus value that counts.

For more details on Series 100 motors, write for Bulletin N-100-R

HOWELL Red Band MOTORS

HOWELL MOTORS

PRECISION-BUILT MOTORS FOR INDUSTRY SINCE 1915

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

For more information fill in page number on Inquiry Card, on page 229

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney &Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain And Universal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., Milwaukee, Wis.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch., Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINE, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.

MILLING MACHINES, Profile

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Bridgeport Machine, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Burke Machine Tool Div., Cincinnati 27, Ohio.

MODEL AND EXPERIMENTAL WORK

See Special Machinery and Tools

MOLD AND DIE COPYING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.

MOLDING MACHINES, Plastic

Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

MOLYBDENUM

Climax Molybdenum Co., New York, N. Y.

MOTORS, Electric

General Electric Co., Schenectady, N. Y.
Howell Electric Motros Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

MOTORS, Hydraulic

Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NAMEPLATES

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

NIBBLING MACHINES

Wales-Strippet Corp., North Tonawanda, N. Y.

NIPPLE THREADING MACHINERY

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

NUMBERING MACHINES

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

NUTS, Thumb or Wing and Cap

Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

OIL CUPS

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

OIL EXTRACTORS AND CLEANERS

De Laval Separator Co., Poughkeepsie, N. Y.

OIL HOLE COVERS

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

OIL GROOVERS

Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OIL SEALS

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois
Madison-Kipp Corp., Madison, Wis.

OILS, Cutting

See Cutting and Grinding Fluids.

OILS, Lubricating

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Socony Mobil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

OILS, Quenching and Tempering

Cities Service Oil Co., 70 Pine St., New York N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago, Ill.

OILS, Soluble

See Compounds, Cutting, Grinding, Metal Drawing, Etc.

OPTICAL FLATS

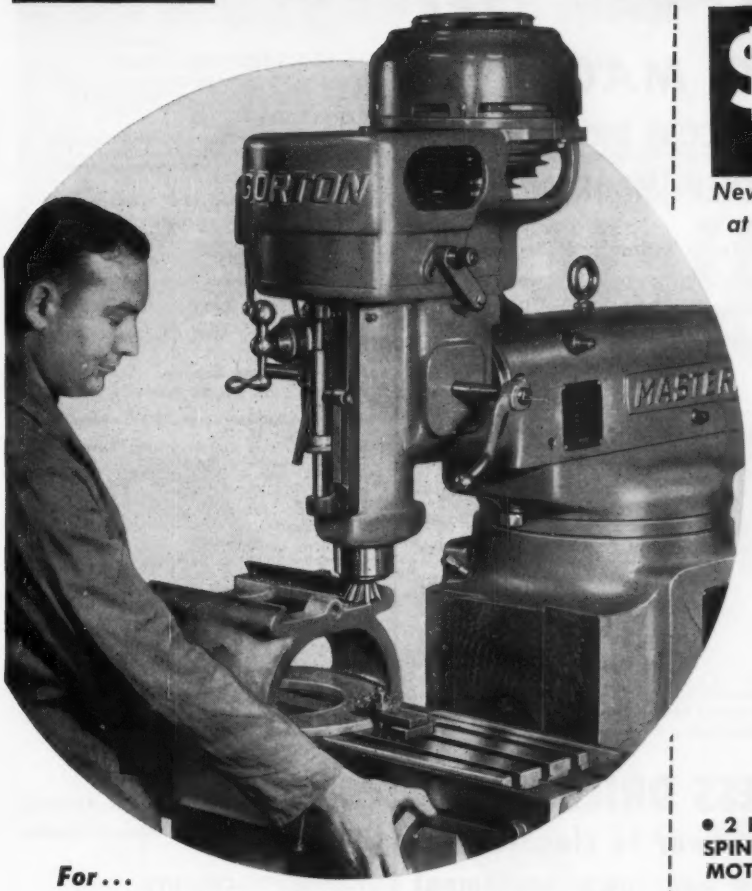
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

ORDNANCE MACHINES, Special

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.
Milholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

(*Continued on page 342*)

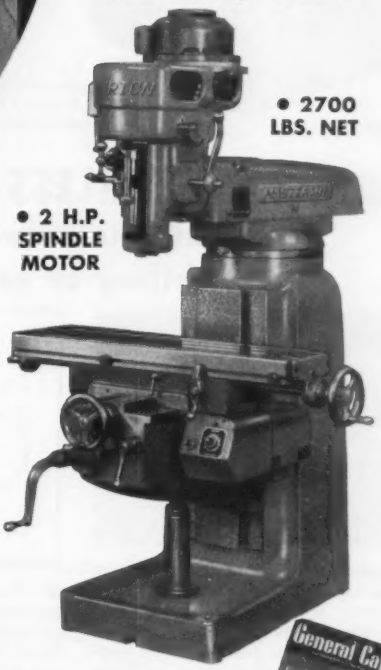
NEW Gorton Mastermil



$2975
(WITH ELECTRICS)

Never before a machine like this at a dollar a pound!

- PRECISION SPINDLE; 10 SPEEDS, 80-5600 R.P.M. STANDARD
- DESIGNED AND BUILT TO PROVIDE SUSTAINED ACCURACY
- LONGITUDINAL FEED, 22 INCHES
- SADDLE LENGTH, 24 INCHES
- CROSS FEED, 10½ INCHES
- VERTICAL FEED OF KNEE, 15¼ INCHES
- SPINDLE FEED, 4 INCHES



- 2700 LBS. NET
- 2 H.P. SPINDLE MOTOR

For...

Milling, boring, duplicating in tool rooms, model shops, pattern shops, production lines, general machine shops, experimental laboratories, machine shops, schools — wherever high-speed vertical milling is done.

Also available...

Infinitely variable spindle feed from ¼ inch to 8 inches per minute.

Infinitely variable table feed (longitudinal) in 4 ranges: from ½ inch to 60 inches per minute.

Ask for special bulletin, No. 2699, on new Gorton Mastermil and for general catalog, 1306-1655, covering the entire Gorton line.

GORTON

SINCE 1893

GEORGE GORTON MACHINE CO.

1306 RACINE ST. • RACINE, WISCONSIN

56-1

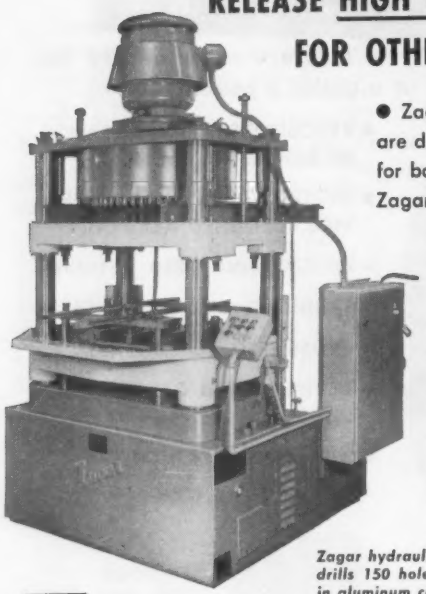
Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

A 8732-1P

For more information fill in page number on Inquiry Card, on page 229

Zagar 4-POST RAM TYPE DRILLING MACHINES

RELEASE HIGH COST DRILL PRESSES FOR OTHER IMPORTANT JOBS

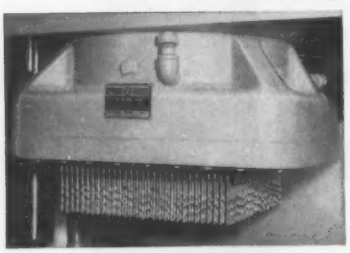


● Zagar hydraulic drilling machines are designed for high speed drilling—for both production and limited runs. Zagar 4-post machines reduce high cost tooling, and handle a range of work that ordinarily necessitates the use of *several different machines*. Very important, Zagar drilling machines release capital equipment for other purposes. Zagar 4-post machines lower your capital investment. They quickly pay out. What, sir, are your production requirements?

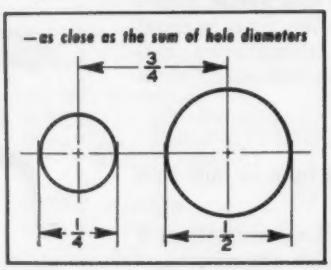
Zagar hydraulic ram-type 4-post machine drills 150 holes, 1/4" through 5/8" dia., in aluminum casting at one pass.

Zagar GEARLESS DRILL HEADS

are the answer to close-center drilling on your own equipment



1000 spindles, drilling simultaneously, are possible with Zagar gearless drill heads. Any pattern drilling any machinable material is standard practice; any size up to 1½" dia. . . . Zagar can design the tooling for the entire drilling job; or, a Zagar gearless drill head can be used on your existing drill press. Zagar engineering is flexible enough to recommend and supply the answer that will cost the least and produce the most.



★ ★ ★

Write for Bulletin M-6

ZAGAR, INC.

23888 LAKELAND BLVD. • CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

PACKING, Leather, Metal, Rubber Asbestos, Etc.
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.

PAINTING EQUIPMENT, Spray
Lowe Bros. Co., Dayton, Ohio.

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

PIPE, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Orban, Kurt, & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

PLANER ATTACHMENTS
Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLANERS, Double Housing and Openside
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A. Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLATE ROLLS
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Surface
Brown & Sharpe Mfg. Co., Providence, R. I.
Challenge Machinery Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

(Continued on page 344)

CUT REPLACEMENT COST More than Half

with NEW T-J REAMERS

RIGHT HAND SPIRAL
RIGHT HAND CUT

LEFT HAND SPIRAL
RIGHT HAND CUT

REPLACE ONLY THE PART THAT WEARS OUT!

1. Cuts replacement cost to less than half!
2. Quick change of heads saves time.
3. Easy to change heads for different metals, increases efficiency.
4. Head and arbor firmly locked together.
5. Wide range of sizes.

Exclusive in design . . . the New-type T-J Reamers cut your replacement costs to *less than half!* Only the quickly installed *head* to replace, after buying original shank. Wide range of interchangeable heads from ½" to 2¾" inclusive, in 1/16" increments are available with right or left hand spiral flutes for thru or blind hole reaming.

Tapered hole in head insures concentricity and *new* thread design assures a snug fit on smoothly ground tapered shank. Reamer operates free from binding or sticking due to cutting portion wearing undersize and creating negative relief. Backed by T-J's 39 years of know-how as one of the largest manufacturers of die sinking milling cutters.

Tomkins-Johnson Co., 617 North Mechanic Street, Jackson, Michigan.

Exclusive, high potential territories open to responsible manufacturers representatives. Write today!

T-J **TOMKINS-JOHNSON**
RIVETORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

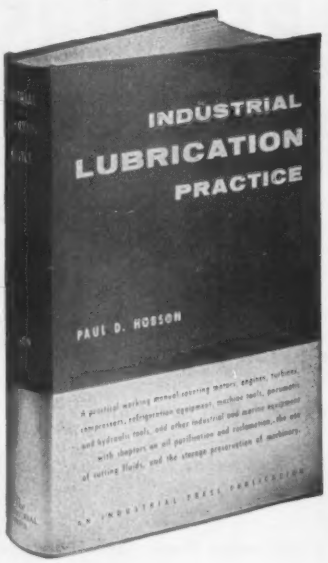
39 Years Experience

For more information fill in page number on Inquiry Card, on page 229

ANSWERS YOUR QUESTIONS ON

INDUSTRIAL LUBRICATION PRACTICE

This book is a guide to sound lubricating practice and its application to cost-saving machine operation and maintenance, and intelligent trouble-shooting. It provides valuable information for all who are responsible for the trouble-free, efficient operation of machinery, mechanical equipment and the prime movers which drive it.



534 Pages
167 Illustrations
$8.00

In Canada or overseas, $8.95

Send for your copy of INDUSTRIAL LUBRICATION PRACTICE today. In one convenient volume it will give you clear-cut, authoritative answers to many of your most perplexing problems. Order directly from the publisher, and the book will be sent immediately. You may return it within five days if you do not find it completely satisfactory. If you send payment in full with your order we pay the postage. Same return privilege applies, of course.

THE INDUSTRIAL PRESS
93 Worth Street
New York 13, N. Y.

PNEUMATIC EQUIPMENT

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.

POLISHING LATHES AND MACHINES

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable

Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Illinois

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads

PRESSES, Arbor

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
duMont Corp., Greenfield, Mass.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Threadwell Tap & Die Co., Greenfield, Mass.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.

PRESSES, Extrusion

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Press Co., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PRESSES, Foot

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
Anderson Bros., Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co. (Hydroform), Cincinnati 9, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Detroit Broach Co., (special & Semi-special) P. O. Box 156, Rochester, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Mch. & Welder Co., Warren, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

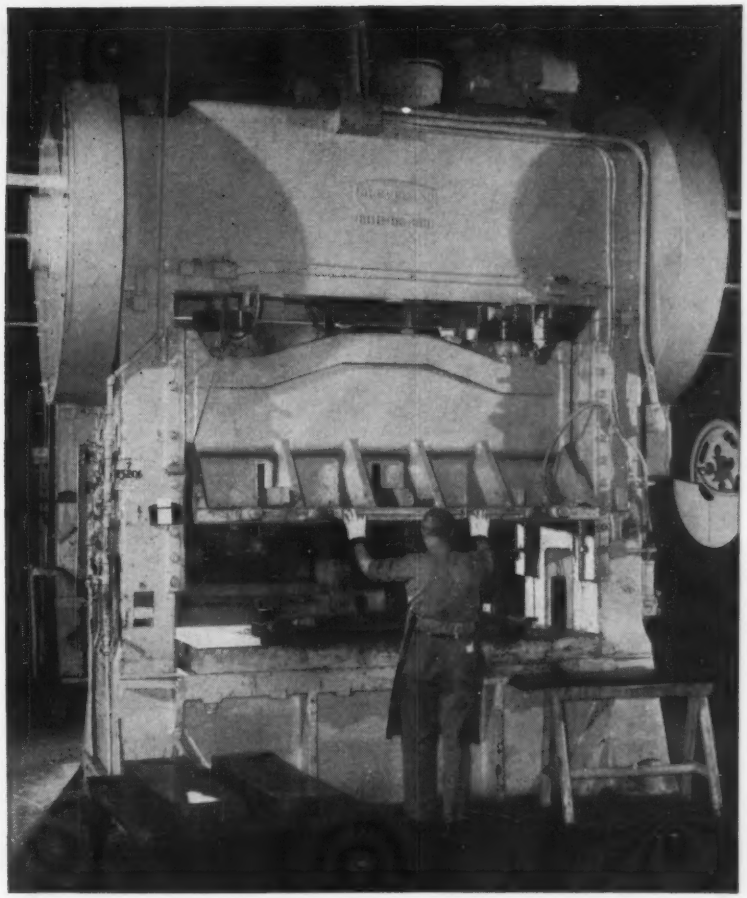
PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Corp., 604 Seventh St., Grand Haven Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426, Clinton, Mo. (Bench)
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincicinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co. (Hydroform), Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 50, Ill.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Johnson Machine & Press Corp., Elkhart, Ind. Pittsburgh, Pa.
L & J Press Corp., Elkhart, Ind.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

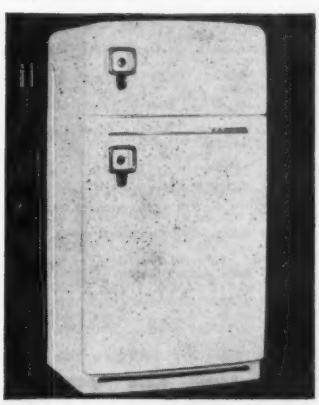
(*Continued on page* 346)



The Cleveland Double-Crank Press shown here draws more than seven parts for the famous Servel Refrigerator.

SERVEL, INC. finds Cleveland Presses

"require very little maintenance... have no clutch problems"



Installed in the Home Appliance Division of SERVEL, INC., Evansville, Indiana, in March of 1951, the Cleveland Double Crank Press you see here has been constantly "on the job" producing parts for famous Servel refrigerators.

Carl Linke, Foreman of the Sheet Metal Department, says, "This Cleveland 80D is a good press. We've used it for most of our draw work for the past five years. During this time it has required very little maintenance. We've had no clutch maintenance problems."

As have many of the nation's leading stamping departments, you, too, will find that Cleveland Presses prove themselves to be easy-to-maintain, low-cost producers. Before buying your next press be sure you have the complete Cleveland story. One of the 11 specialized types of Cleveland Presses is sure to be your answer to greater stamping economy. Write or call today!

THE CLEVELAND PUNCH & SHEAR WORKS CO.

Established 1880

POWER PRESSES – FABRICATING TOOLS

E. 40th & St. Clair Avenue, Cleveland 14, Ohio

Offices at: NEW YORK • CHICAGO • DETROIT
PHILADELPHIA • E. LANSING

CITY FOUNDRY DIVISION • SMALL TOOL DEPARTMENT

PRESSES, Straightening

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Eng. Corp., 470 Woodward Ave., Buffalo, N. Y.
Niagara Machine & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & Kenwood Ave., Chicago, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

PROFILING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George Machine Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I.

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gray-Mills Co., 1948-52 Ridge Ave., Evanston, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incroporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY

Allen, Alva F., Box 426, Clinton Mo.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

Ace Drill Corp., Adrian, Michigan.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

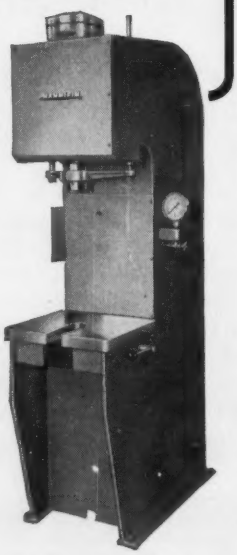
REAMERS, Taper Pin

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Gresenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(Continued on page 348)

PRICE LIST

ON HANNIFIN STOCK HYDRAULIC PRESSES



1-TON	$ 552
2-TON	$ 627
5-TON	$1,286
8-TON	$1,581
10-TON	$1,855
25-TON	$3,681

Prices complete with motors and starters F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.

DELIVERY FROM STOCK

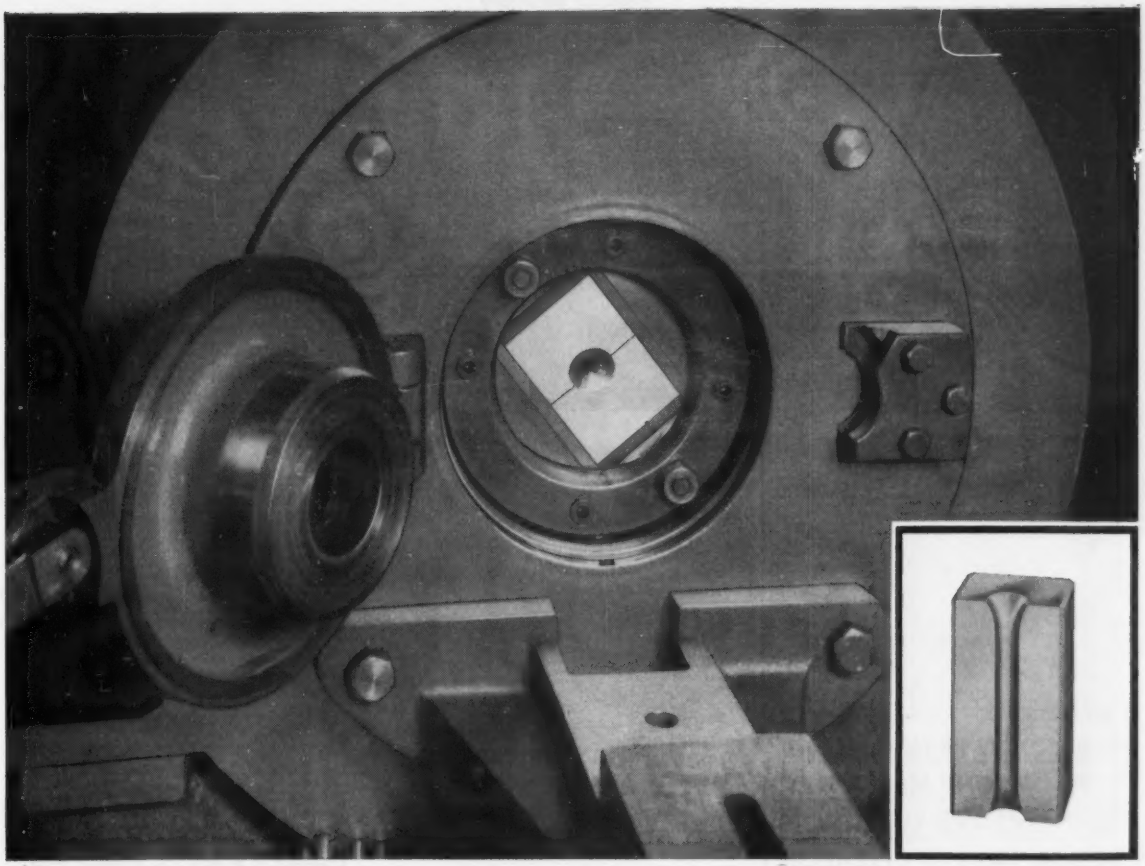
Demand for these popular presses is so consistent we are able to produce them in quantity and pass the savings along to you.

Construction-wise and quality-wise these small general-purpose presses are identical to the larger Hannifin presses, up to 150 tons. Special, optional controls when needed.

WRITE for complete information on the Hannifin Hydraulic Press you're interested in.

HANNIFIN

HANNIFIN CORPORATION, 509 S. WOLF ROAD, DES PLAINES, ILLINOIS



KENNAMETAL* Dies swage up to 50 times more pieces than steel

with more accurate dimensions and better quality

By switching to dies made of Kennametal Grade K90, a manufacturer of hand tools has obtained these important benefits on a hot swaging operation:

- increased production of swaged steel alloy rods from 100 to 1000 pieces between dressings . . . machine down time greatly reduced.
- swaged pieces are now more uniform and of better quality.
- the Kennametal dies are outlasting the steel dies 30 to 50 times.

Although the Kennametal die blocks cost about five times more than the steel dies previously used, they quickly pay for themselves and show substantial profits on the investment.

As Kennametal dies and die sections are showing similar results on many types of operations, why not select Kennametal for your next die parts . . . for blanking, compacting, cold heading, cupping, drawing, forming, perforating, piercing, slitting, stamping or swaging.

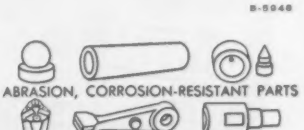
You can choose from Kennametal's "90 Series" with six grades or the exclusive non-galling "80 Series" with three grades. These grades provide a range of carbides that meet the specific requirements of any die application.

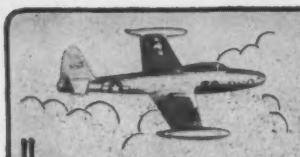
A Kennametal die engineer will gladly work with you or your die maker in applying the right grade of Kennametal for your dies. Call him at your nearest Kennametal office or write to KENNAMETAL INC., Latrobe, Pennsylvania.

*Registered Trademark

B-5948

INDUSTRY AND KENNAMETAL ...Partners in Progress





"THIS LUBRICANT EXTENDED BEARING LIFE 50%"

—says REPUBLIC AVIATION CORP.
Makers of the famous F-84E THUNDERJET

"Under actual tests, LUBRIPLATE extended bearing life fifty per cent or better as compared to other lubricants. It was also found that, during test, LUBRIPLATE increased efficiency of machines twenty per cent by reducing friction loss. Republic has been using LUBRIPLATE successfully for the past eight years."

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE

LUBRIPLATE LUBRICATION

MAKES CARS AND TRUCKS RUN BETTER AND LAST LONGER

LUBRIPLATE H.D.S. MOTOR OIL . . . THE OIL THAT NEEDS NO ADDITIVES

For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

REAMING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kaufman Manufacturing Co., Manitowac, Wis.
Michigan Drill Head Co., Detroit 34, Mich.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

RECORDING INSTRUMENTS

National Acme Co. (for counting), 170 E. 131st St., Cleveland, Ohio.

REELS, Stock, Standard and Automatic

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnace

Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature

General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.

Oakite Products, Inc., 19 Rector St., New York, N. Y.

RETAINING RINGS FOR BEARINGS, Etc.

Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RHEOSTATS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

RIVET SETS

Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

RIVETERS, Hydraulic

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.

RIVETERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Illinois
Wood & Co., R. D. Public Ledger Bldg., Philadelphia, Pa.

RIVETING MACHINES

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Townsend, H. P., Mfg. Co., Elmwood, Conn.

RIVET MAKING MACHINES

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

RUBBER PRODUCTS

Garlock Packing Co., Palmyra, N. Y.

RULES, Steel

Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

RUST PREVENTIVES

Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
International Chemical Co., 2628 N. Mascher St., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT

See Blast Cleaning Equipment

SANDERS

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Ingersoll-Rand Co., Phillipsburg, N. J.
Mattison Machine Works, Rockford, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Illinois.

SAW BLADES, Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.

SAW SHARPENING MACHINES

Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular

Consolidated Mch Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

SAWING MACHINES, Friction

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWING MACHINES, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

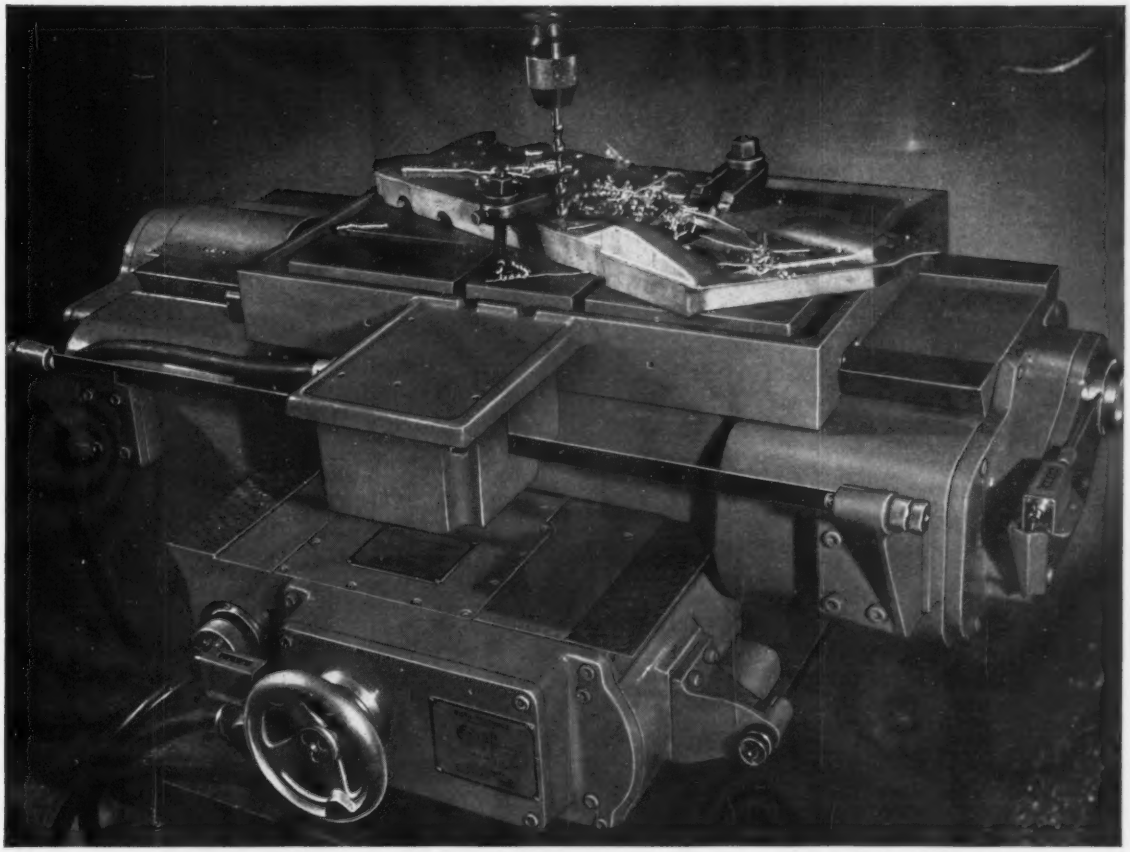
SAWING MACHINES, Power Hack

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWS, Circular Metal Cutting

Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

(*Continued on page 350*)



"MICRO-POSITIONER"

NEW!! tape-controlled indexing table cuts set-up time, eliminates jigs and fixtures on repetitive drilling, reaming, tapping and many other operations

The "Micro-Positioner", a precision-made, automatic indexing table, makes possible reproduction of complex drill or tapping patterns repetitively and accurately (.001") with little effort or skill required by the operator. A sensing mechanism that "feels" indentations in a steel tape directs the movements of the table in the horizontal plane, either transversely or longitudinally. Compact and easily portable, this unit can be moved at any time as production requires. Used in combination with radial drills, milling machines, turret drills or other suitable spindles, the "Micro-Positioner" results in a universal production machine of unlimited potential. And this can be accomplished at remarkably low cost.

Write for Bulletin M-6.

THE MICRO-POSITIONER CORPORATION
716 Wilshire Blvd., Santa Monica, California • TExas 0-5070

Licensed Manufacturer: Topp Industries, Los Angeles, Calif.

SAWS, Metal Cutting Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

SAWS, Portable Electric
Thor Power Tool Co., Aurora, Illinois

SAWS, Screw Slotting
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

SCRAPERS, Hand and Power
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Illinois

SCREW DRIVING AND NUT SETTING EQUIPMENT
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Illinois

SCREW MACHINE TOOLS AND EQUIPMENT
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P.O. Box 350. Worcester, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eastern Mch. Screw Corp., New Haven, Conn.
Mueller Brass Co., Port Huron 35, Mich.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, M. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Townsend, H. P., Mfg. Co., Elmwood, Conn.

SCREW MACHINES, Hand See also Lathes, Turret
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.

SCREWS, Cap, Set, Safety Set and Machine, Etc.
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H. Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-Tapping, Drive
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

SCREWS, Thumb
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SEALS AND RETAINERS, Oil or Grease
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois
Garlock Packing Co., Palmyra, N. Y.

SECOND-HAND MACHINERY, Etc.
Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Freeman, Samuel T. & Co., 1808-10 Chestnut St., Philadelphia, 3, Pa.
Miles Machinery Co., Box 770, Saginaw, Mich.

SEPARATORS, Centrifugal
De Laval Separator Co., Poughkeepsie, N. Y.

SEPARATORS, Oil or Coolant
Barnes Drill Co., (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

SHAFTING, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SHAFTS
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

SHAFTS, Hollow-Bored
Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground
Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SHAPER-PLANERS
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPERS
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPERS, Structural
Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

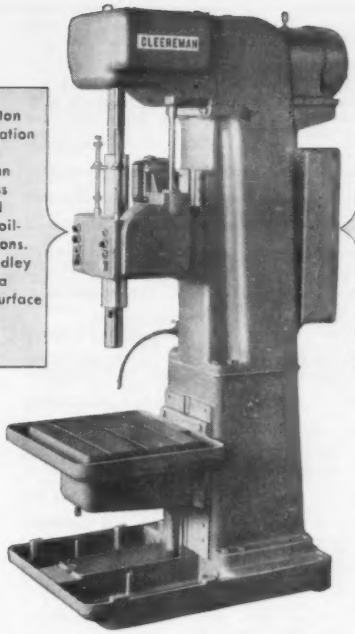
SHEARS, Rotary
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

SHEARS, Squaring
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Div. of the Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co., (Blades), 470 Main St., Fitchburg, Mass.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

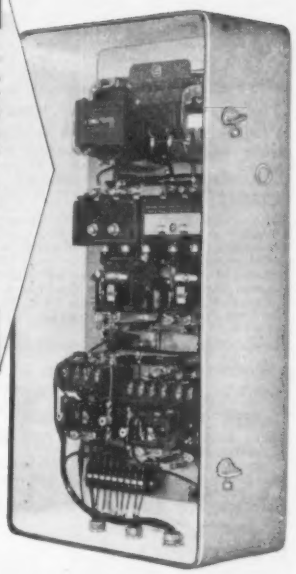
SHEET METALS
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
New Jersey Zinc Co., 160 Front St., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

(*Continued on page* 352)

Eight button control station built into Cleereman drill press equipped with A-B oiltight buttons. Allen-Bradley also lists a line of surface mounted stations



Cleereman drill press is factory equipped with the special A-B automatic motor control panel shown here, using strictly standard components

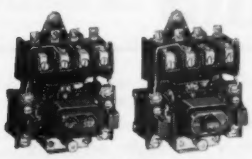


FOR DEPENDABLE AUTOMATION • • STANDARDIZE ON ALLEN-BRADLEY CONTROLS

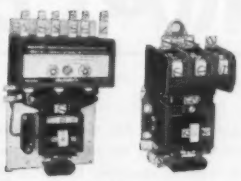
Control panels for an automation line of special machinery must be ultradependable to make the installation a success. The failure of a single item in the control sequence may shut down the entire production line. That is why all electrical and magnetic components must be good for *millions of trouble free operations.*

A-B Quality

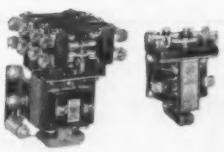
All Allen-Bradley control components, of which a few are shown below, have been time-tested in thousands of industrial applications. They are QUALITY products designed for trouble free service in the toughest automation layouts. Permit us to discuss your control requirements with you. Call on the nearest Allen-Bradley district office.



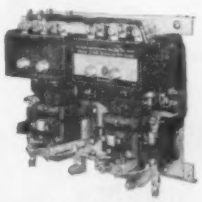
SOLENOID STARTERS
With push buttons • with selector
The Form 2 construction is for remote control



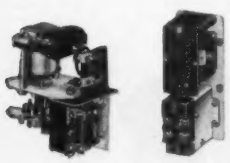
CONTACTORS
From one to eight poles
Ratings up to 1000 amps



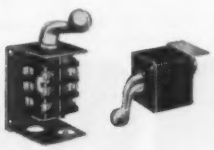
SOLENOID RELAYS
In a wide variety of types



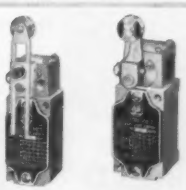
REVERSING STARTERS
Up to 600 hp, 440-550 v



TIMERS
Motor-driven • pneumatic
Other types available



DRUM CONTROLLERS
Up to 500 hp, 440-550 v



OILTIGHT LIMIT SWITCHES
A complete line

TERMINAL BLOCKS
Interlocking to any length

Allen-Bradley Co.
1331 S. First St.
Milwaukee 4, Wis.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

In Canada—
Allen-Bradley Canada Ltd.
Galt, Ont.

For more information fill in page number on Inquiry Card, on page 229

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div. Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHIMS

Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Shenango-Penn Mold Co., Dover, Ohio.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.

SOCKETS

Armstrong Bros., Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SPECIAL MACHINERY AND TOOLS

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. C.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., Detroit, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros., & Co., 12th and Columbia Aves, Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydraulic Press Mfg., Co., Mount Gilead, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Mercury Engrg. Corp., Milwaukee, Wis.
Michigan Drill Head Co., Detroit 34, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.

Rowbottom for Cams

More than a Half-Century's "Knowhow" is at your service . . . here

You don't have to ask questions as to the ability of Rowbottom to meet your most exacting specifications for the cams you need. Specialized experience extending for over fifty years on cams and cams only is back of the pioneering service available from Rowbottom. So when you need cams you need the "knowhow" which Rowbottom is in position to apply to your problem . . . a "knowhow" available from design to manufacture on cams of all types including hardened and ground cams for longer life and greater capacity. Send drawings and details for cost estimates. Our complete facilities assure prompt service.

The
ROWBOTTOM MACHINE CO.
WATERBURY CONN.

Rowbottom also manufactures Cam Milling and Cam Grinding Machines for producing all types of cams economically. Ask for illustrated literature.

Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Boston Gear Work, 320 Main St., North Quincy 71, Mass.
Brad Foote Gear Works, 1309 So. Cicero Ave., Chicago 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Philadelphia Gear Works, Inc., Erie Ave. and G. St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

SPINDLES, Boring and Milling

Pope Mchry. Corp., Haverhill, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverhill, Mass.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio.

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STAMPS, Steel and Marking Dies

Acromark Co., 9-11 Morrell St., Elizabeth, N. J.

STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Cold Drawn

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co.), Div., 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div.) 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

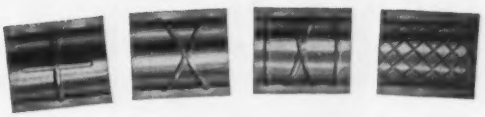
STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh Pa.

(*Continued on page* 354)

High Speed

CONTINUOUS OIL GROOVING



500

PIECES PER HOUR!

High-production and economical operation are the features of the WICACO CONTINUOUS OIL GROOVER . . . capable of completing as many as 500 grooved pieces per hour in routine practice—even with unskilled labor!

The operator loads and unloads the work **without stopping the Machine**—a valuable time-saving advantage made possible by the WICACO upright construction of the spindle and stationary chuck. Feed-lever automatically returns to neutral position when cutting tool reaches its proper depth. The spindle—not the chuck—revolves, permitting fast and convenient grooving of a variety of larger and irregular work. Maximum depth of groove 7/32", maximum width 3/8", grooves may be cut in work from 1/4" I.D. to 4 1/2" I.D.; standard chuck holds work to 4 1/2" O.D.; stroke of spindle from 0" to 7"; floor space 24" dia.; weight of machine about 950 lbs.

Send us sample bearings to cut to specifications. We will return them, properly grooved, with a record of the time required and a cost-estimate. No obligation. Or, write for detailed, well-illustrated Bulletin.

WICACO

SINCE 1868

THE WICACO MACHINE CORPORATION

WAYNE JUNCTION PHILADELPHIA 44, PA.

SOUTH BEND
16" 16-SPEED LATHE

The wide range of spindle speeds on this new lathe cuts machining time because the operator quickly selects the right speed for each operation. Push button control provides a fast change from any high speed to the corresponding low speed. Its 48 longitudinal and cross-feeds assure maximum efficiency on every job. *Write for catalog.*

OPTIONAL FEATURES
available at extra cost

Cam Lock Spindle 4" Type D1

Long Taper Key Drive Spindle—Size L00

Hardened and Ground Ways

Also, Cross-feed and Compound Rest Screws with hardened and ground threads.

SPECIFICATIONS

Engine and Toolroom models. Swing—16¼". Collet capacity—1". Between Centers—33 to 129" max. Spindle Speeds—sixteen, 15 to 980 r.p.m. (approx.) Base Price—$2,259.

SOUTH BEND LATHE
SOUTH BEND 22, INDIANA

Builders of Lathes, Milling Machines, Shapers, Drill Presses, Grinders

STEEL, Tool and Die
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS
See Alloys, Steel

STEEL BARS
See Bars, Steel

STEEL STOCK GROUND FLAT
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

STELLITE
Haynes Stellite Div., Union Carbide & Carbon Corp., (Alloy), 30 E. 42nd St., New York, N. Y.

STOCKS, Die
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.

STONES, Oil or Sharpening
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS
Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES
Starrett, The L. S. Co., Athol, Mass.

STRAIGHTENERS, Flat Stock and Wire
Sesco, Inc., 8881 Central, Detroit 4, Mich.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

STUD SETTERS
Errington Mechanical Laboratory Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.

SUB-PRESSES
Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES
See Plates, Surface

SWAGING MACHINES
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.

SWITCHES
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.

(*Continued on page* 356)

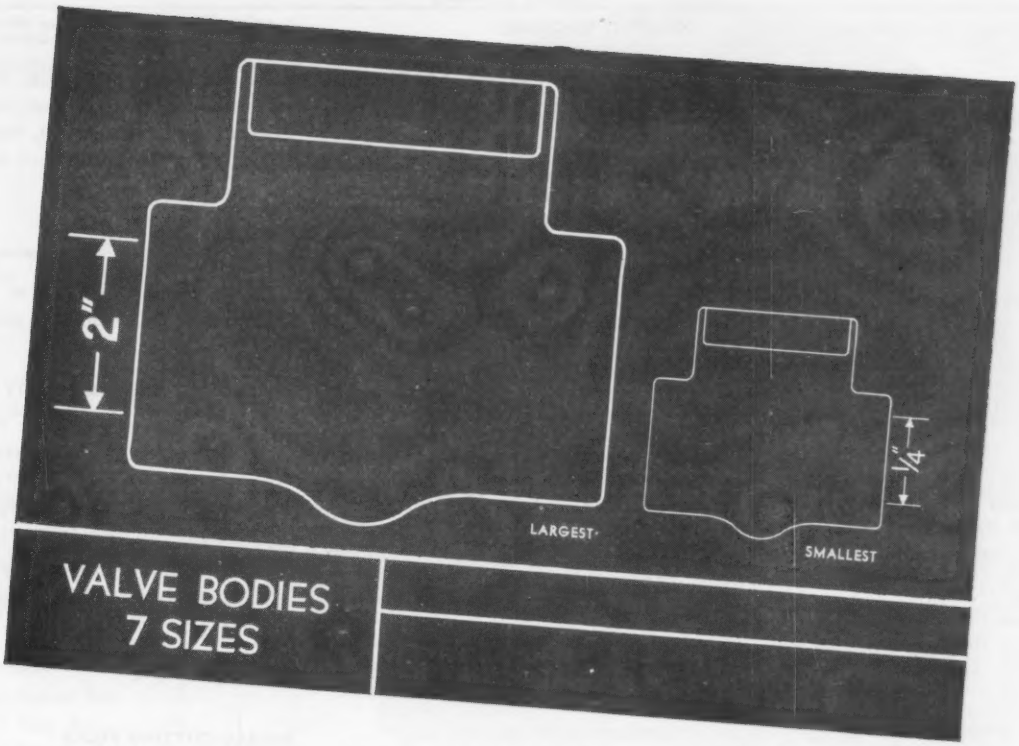
But why MEN over 45?

Our doctors still don't know *why*, but if you are a man over 45 you are six times as likely to develop lung cancer as a man of your age twenty years ago. They *do* know, however, that their chances of saving your life could be about *ten times* greater if they could only detect cancer long before you yourself notice any symptom. (Only 1 in every 20 lung cancers is being cured today, largely because most cases progress too far before detected.)

That's why we urge that you make a habit of having your chest X-rayed every six months, no matter how well you may *feel*. The alarming increase of lung cancer in men over 45 more than justifies such precautions. Far too many men die *needlessly!*

Our new film "The Warning Shadow" will tell you what every man should know about lung cancer. To find where and when you can see this film, and to get life-saving facts about other forms of cancer, phone the American Cancer Society office nearest you or simply write to "Cancer"—in care of your local Post Office.

American Cancer Society

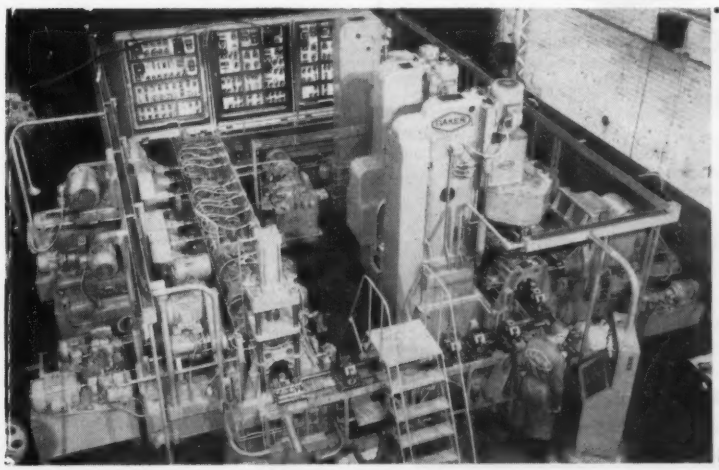


All finished on this adjustable

BAKER TRANSFER MACHINE

1/4" valve bodies . . . or 2" bodies at 73 per hour depending upon size. With change-over from one size to another at a bare minimum! It is accomplished simply by changing tools and platens.

Specially built for Manning, Maxwell & Moore, Inc., this platen type transfer machine is rectangular instead of inline — to reduce required floor space and to keep down the number of platens. It's composed of 26 stations which perform drilling, boring, facing, tapping and broaching. Yes, Baker automation is flexible! Get the full story.



BAKER

AUTOMATION

Best in the long run
Practical in the short run

Free Data **MAIL COUPON**

BAKER BROTHERS INC., Dept. M-656
TOLEDO, OHIO
Please send free data on Baker automation.

NAME AND TITLE

COMPANY

ADDRESS

CITY ZONE STATE

General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

TACHOMETERS

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

TAPER PINS, Standard

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.

TAP HOLDERS

Burg Tool Mfg. Co., Inc., 15001 S. Figueroa St., Gardena, Calif.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

TAPPING ATTACHMENTS AND DEVICES

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 70, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Challenge Mchry Co., Grand Haven, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Michigan Drill Head Co., Detroit 34, Mich.

TAPS

Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Continental Tool Works, Div. Ex-Cell-O Corp., Detroit 32, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing

Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

THREAD CUTTING MACHINERY

Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Lees-Bradner Co., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

THREAD GAGES

See Gages, Thread

THREAD GRINDING MACHINES

See Grinding Machines, Thread

THREAD MILLING MACHINES

Coulter, James, Machine Co., Bridgeport 5, Conn.
Lees-Bradner Co., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Waltham Machine Works, Newton St., Waltham, Mass.

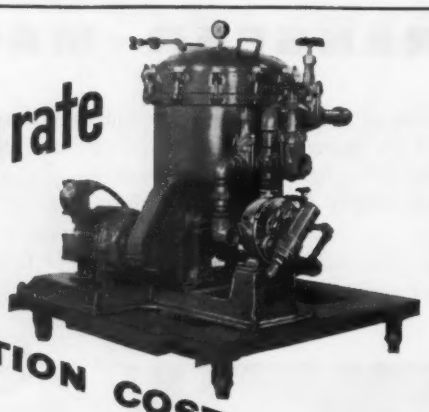
THREAD ROLLING HEADS

National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

THREAD ROLLING MACHINES

Landis Machine Co., Waynesboro, Pa.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.

(*Continued on page* 358)



HIGH Flow rate
LOW OPERATION COST
WITH VIKING PUMPS

Sparkler Manufacturing Company, Mundelein, Illinois, assures high quality performance, high flow rate, and low operation cost by including Viking pumps as original equipment on their horizontal plate filters for clarifying resinous coatings

Filters range in capacity from 300, 500, 700, 1000, 1400, 1700, 2000 and 3000 gallons per hour, and Viking pumps are available in the sizes required to meet all of these capacities.

Vikings are adaptable to many pumping requirements—perhaps yours, too. For information, write for Bulletin 56Sj.

VIKING PUMP COMPANY
Cedar Falls, Iowa, U.S.A. In Canada, it's "ROTO-KING" pumps
See our catalog in Sweets

Specifications and Major Features of 1 3/8" and 1 5/8" Model AB CLEVELAND DIALMATICS

	1 3/8" Model AB	1 5/8" Model AB
Max. Round Bar	1 3/8"	1 5/8"
Max. Hex. Bar	1 3/16"	1 13/32"
Max. Square Bar	31/32"	1 1/8"
Horsepower	7 1/2	7 1/2
Idle Motion Time	6.3 secs.	6.3 secs.
Stock Feed Stroke	9"	9"
Turning Length	4 7/8"	4 7/8"
Dia. Tool Circle	9"	9"
No. Turret Holes	5	5
Cross Slide Travel	4"	4"
Cross Slide Tooling Width	6 11/16"	6 11/16"

Infinitely variable spindle speeds.
Spindle speed range—40 to 3200 R.P.M.
Cleveland exclusive quick change collet.
Quick change feedshell pads which require no screws.
Variable tool feeds through electric feed drive.
High speed Geneva turret index.
Flame hardened double cross slides.
Quick hand crank stock feed adjustment.
Universal camming and easily adjustable cam drums.

Write for new 1 3/8" and 1 5/8" Model AB Bulletin

gives you maximum productivity with new 1 3/8" and 1 5/8" Model AB

CLEVELAND DIALMATICS

Cleveland brings to metalworking another major advancement in single spindle bar automatic machine design! Now, by making *dial settings* on the control panel, you preselect the *exact* forward and reverse tool feed——and the *exact* forward and reverse spindle speed—for each of five working turret tools. Each tool is completely and individually controlled throughout the cycle . . . *tuned* for maximum cutting efficiency!

There are *no change gears*. Spindle speeds are electronically controlled and infinitely variable between 40 and 3200 r.p.m. You can preselect and set 10 different spindle speeds for each machine cycle. Spindle speed changes and reversals are entirely automatic and are made through electric clutches, which make the number of changes or reversals per minute practically unlimited.

A few of many modern features of these new Clevelands are listed at left. It will pay you to get full information. Get in touch with a Cleveland sales engineer. He'll give you the full story on the many economies these new Clevelands can bring to your plant.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4936 Beech Street
Cincinnati 12, Ohio
SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

1 KEYWAY MINUTE CENT

Number one time and money saver — that's the Minute Man Keyway Broach Kit. With it you can cut a keyway in just one minute for as little as one cent. For keyways from 1/16" to 1" in any bore from 1/4" to 3".

Minute Man Broaches for square and hexagonal holes and Production Type Keyway Broaches are available from stock from your Industrial Distributor.

The duMONT CORPORATION
Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST M describing Square Broaches, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....

Company.....

Address.....

Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R.R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL BITS, Special Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1200 Woodward Heights Blvd., Ferndale, Mich.

TOOL CONTROLS

Royal Design & Manufacturing, Inc., 4133 E. Ten Mile Rd., Centerline, Mich.

TOOL GRINDERS

See Grinding Machines for Sharpening, Turning and planing Tools

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Burg Tool Mfg. Co., Inc., 15001 S. Figueroa St., Gardena, Calif.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol, St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOLMAKERS' INSTRUMENTS

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped

Ace Drill Corp., Adrian, Michigan.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Besly-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Spiral Step Tool Co., Chicago 25, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

TOOLS, Lathe, Shaper and Planer

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
du Mont Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TRANSFER MACHINES, Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TRANSFORMERS

General Electric Co., Schenectady, N. Y.

TRANSMISSION, Variable Speed

Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.

TUBE FORMING AND WELDING MACHINES

Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

TUBE MILLS

Abbey-Etna Co., 2444 Maplewood Ave., Toledo 10, Ohio.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.

TURNING & BORING MACHINES

Hoern & Dilts Div., New Britain Machine Co., Saginaw, Mich.

TWIST DRILLS

See Drills, Twist

UNIVERSAL JOINTS

Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

Super finish for turbo-supercharger

A leading manufacturer of turbo-superchargers uses Osborn's Brushamatic® 3A to cut compressor wheel finishing costs from 48¢ to 16¢ per part.
®Trade-Mark

THIS aluminum compressor wheel is the heart of a new turbo-supercharger designed to increase engine horsepower up to 60%. Osborn power brushing methods remove all machining burrs from this compressor wheel . . . maintain a finish tolerance of two ten-thousandths of an inch. In addition to improving the quality of this compressor wheel, Osborn power brushing cuts finishing time from 12 minutes to 4 minutes per part.

The automotive industry is just one of many using Osborn power brushing to improve and speed up finishing operations.

An **O**sborn **B**rushing **A**nalysis, made in your plant, will show how *you* can improve finishes, reduce finishing costs. Write *The Osborn Manufacturing Company, Dept. D-42, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.

VALVE CONTROLS

Philadelphia Gear Works, (Motorized), Erie Ave. and G St., Philadelphia, Pa.
Versa Products Co., Inc., 249 Scholes St., Brooklyn 6, N. Y.

VALVES, Air

Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

VALVES, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines Ill.
Hunt, C. B., & Son, 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Versa Products Co., Inc., 249 Scholes St., Brooklyn 6, N. Y.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

VALVES, Pneumatic

Versa Products Co., Inc., 249 Scholes St., Brooklyn 6, N. Y.

VIBRATION INSULATION

American Felt Co., Glenville, Conn.

VISES, Machine

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engineering Co., Frankenmuth 2, Mich.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

VISES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

VISES, Planer and Shaper

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elam and Garrard Ave., Cincinnati, Ohio.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

VOLTMETERS

General Electric Co., Schenectady, N. Y.

WELDING AND CUTTING EQUIPMENT Oxyacetylene

Linde Air Products Co., Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING AND CUTTING GAGES

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING EQUIPMENT, Electric Arc

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Federal Mch. & Welder Co., Warren, Ohio.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

WELDING EQUIPMENT, Electric, Spot, Butt, Seam, Etc.

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Federal Mch. & Welder Co., Warren, Ohio.

WELDING POSITIONER

du Mont Corp., Greenfield, Mass.

WELDMENTS

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

WIPERS

Scott Paper Co., Chester, Pa.

WIRE

American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (American Steel & Wire Co. Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINERY

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

WIRE NAIL MACHINERY

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Ryerson, Jos. T. & Son, Inc., 2588 W. 16th St., Chicago 18, Ill.

WOODWORKING MACHINERY

Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Mattison Machine Works, Rockford, Ill.

WORM DRIVES

Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.

WRENCHES

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Ingersoll-Rand Co. (Impact, Pneumatic, Electric), Phillipsburg N. J.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Detachable Socket

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Impact

Thor Power Tool Co., Aurora, Illinois

WRENCHES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

WRENCHES, Ratchet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Tap

Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.

WRENCHES, Torque Measuring

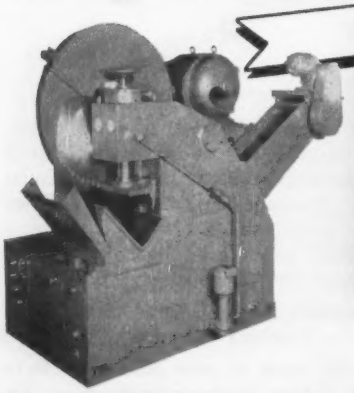
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
LaSalle Tool, Inc., Detroit, Michigan
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

ZINC

New Jersey Zinc Co., 160 Front St., New York, N. Y.

Proved Better

BY PERFORMANCE



Ruthman Gusher Coolant Pumps

Illustrated is a Loma Saw SPH-36 equipped with a Gusher Coolant Pump and arranged for Billets and Slabs,Courtesy of the Loma Mach. Mfg. Co., Inc.

The year in and year out popularity of Ruthman Gusher Coolant Pumps with the leading machine tool builders is ample proof of their outstanding performance.

Gusher Coolant Pumps give you split second coolant flow — require no priming. Their sturdy construction, pre-lubricated ball bearings, electronically balanced rotating assembly assure you of long trouble-free life with minimum maintenance.

THE RUTHMAN MACHINERY CO.
1807 Reading Rd. Cincinnati, Ohio

...for piloted taps from stock

SEE YOUR

Threadwell

DISTRIBUTOR

FOR THE FINEST IN
CUTTING TOOLS AND GAGES

Made by THREADWELL, Greenfield, Mass.

Micrometric Travel Control for Lathes • Mills • Grinders • Drill Presses

Acra-Stop

cuts costs by increasing production —prevents waste

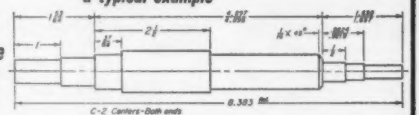
only $130.00
f. o. b. Santa Monica

The HOW with *Acra-Stop*

Accurate cutting to within one-tenth of a thousandth. Cuts set-up time nearly in half. Will produce a useable part, the second part off. The device makes it possible to set up an engine lathe with up to 80 precision stops in a 10" run.

SET UP AND RUNNING TIME CUT ONE-HALF with *Acra-Stop*

a typical example



Precision made and fully guaranteed...

Acra-Stops may be purchased direct...Send your Order TODAY!

JOSLYN-HUDSON, INC. subsidiary of **AMELCO, INC.** 2040 Colorado Ave. Santa Monica, Calif.

PARKSON GEAR TESTERS

IN SIZES UP TO 30" CENTER DISTANCE

Provide the Universally-accepted FUNCTIONAL test not only for SPUR but also for BEVEL, SPIRAL and WORM GEARS. 5", 9" and 30" sizes available for Immediate Delivery—

Request List M1

Geo. SCHERR OPTICAL TOOLS, Inc.
200 MA LAFAYETTE STREET • NEW YORK 12, N. Y.

GEARS

Made to Your Specifications

You and we can form a team—you to draw up the specification; we to make the gears—that will be profitable to both of us. Gears of all types, all sizes, all materials. Design-engineering service available.

Custom Gears Exclusively

DIEFENDORF GEAR CORPORATION

Syracuse 1, N. Y.

DIEFENDORF GEARS

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2303R North 11th St. • St. Louis 6, Mo.

CUT SCRAPER TIME

END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2303R NORTH 11TH ST., ST. LOUIS 6, MO.

IMPROVE FACING OPERATIONS

ON BORING MILLS - DRILLS - LATHES
MILLERS AND RADIALS

M-D facing Head feeds automatically. Lathe tool bit travels radially from center outward or reverse. 10 sizes, 6" to 46" dia. Write for bulletin, prices.

MUMMERT-DIXON CO. 126 Philadelphia St. HANOVER, PA.

only

THRIFTMASTER *Universal Joint Type* **DRILL HEADS**

have these exclusive* features

6 Standard Models

Models U-608 and U-1000—Ball Bearing

Models U-6208 and U-10128—Plain Bearing, 11/16" or 1/2" min. centers.

Models U-608-BS and U-1000-BS — Ball Bearing Gear Case, Plain Spindles.

Semi-Standard Heavy Duty Full Ball Bearing

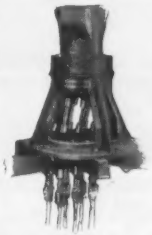
1/2" in Cast Iron — 1 7/16" min. centers 7 1/8" or 9 3/4" Dia.

1/2" in steel—1 13/16" min. centers 7" or 9 5/8" Dia.

Also Larger Adaptations and Full Line of Fixed Center Drill Heads.

• Standard Full Ball Bearing Construction, including Spindles

Driving assembly is FULL BALL BEARING mounted with 3 Bearings on each spindle. Thrust load carried by radial thrust bearings.



★ Standard Slip-on and Slip-Off Template Construction

For accurate setting and locating spindle brackets are machined to receive slip-on and slip-off template.

WRITE FOR FULL INFORMATION

Subsidiary of Thomson Industries, Inc.

THRIFTMASTER *Products Corporation*

1014 N. PLUM STREET
LANCASTER, PENNA.

Also Makers of DORMAN AUTOMATIC REVERSE TAPPERS

M&M

NEW HYDRAULIC KEYSEATER

In this new M & M Keyseater hydraulic action produces exceptionally smooth performance. Cutter stroke and feed are automatically controlled, tool relief is also automatic. High degree of accuracy is assured. Available in a wide range of sizes. Rugged construction features insuring long life are based on 67 years experience. Mechanical drive keyseaters available for cutting keyways in all sizes up to 5" wide and 60" long. Write for specification folder.

90-R

MITTS & MERRILL

61 Holden Street • SAGINAW, MICHIGAN

SHORE SCLEROSCOPE HARDNESS TESTERS

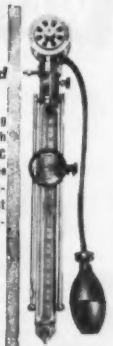
Pioneer American Standard SINCE 1907

MODEL D

Available in Model C-2 direct reading or in Model D dial indicating with equivalent Brinell and Rockwell C Hardness Numbers. May be used free hand or mounted on bench clamp. Sensitive over entire range from softest to hardest of metals without adjustment. Non-injurious to work.

OVER 40,000 IN USE

THE SHORE INSTRUMENT & MFG. CO., INC.
90-35C Van Wyck Exp.
Jamaica 35, N. Y.



MODEL C-2

FREE... 64 PAGE CATALOG

WORLD'S LARGEST LINE OF WORK HOLDING EQUIPMENT—CHUCK JAW BLANKS, CAST ALUMINUM AND MALLEABLE KNOBS, WHEELS, HANDLES—PLUS HUNDREDS OF OTHER JIG AND FIXTURE COMPONENTS

COMPLETE DETAILED SPECIFICATIONS
ENGINEERING DRAWINGS • COST SAVING DATA
write for your copy—TODAY!

JERGENS TOOL SPECIALTY CO.
Dept. M-6, 712 E. 163rd St., Cleveland 10, Ohio

STEEL HAND AND POWER

CHICAGO BENDING BRAKES

For Single and Quantity Runs Bending Steel Plate and Sheet Metal

Special Bending Brakes
Double Folder Brakes

DREIS & KRUMP MANUFACTURING COMPANY

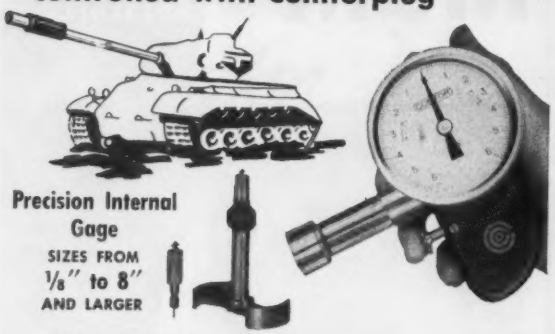
CHICAGO STEEL BENDING BRAKES AND PAN BRAKES PRESS BRAKES

7412 S. Loomis Blvd., Chicago 36, Illinois

For more information fill in page number on Inquiry Card, on page 229

Did you know that . . .

Major ordnance items are quality-controlled with Comtorplug



Precision Internal Gage
SIZES FROM 1/8" to 8" AND LARGER

COMTORPLUG with interchangeable expanding plugs to gage simple or special bores from 1/8" to 8" dia.

UNIQUE ADVANTAGES

- Positive gaging accuracy to fraction of .0001" regardless of who operates it.
- Indicates actual size, a fixed—not passing—reading.
- Positive 2-point gaging—automatic centering.
- Shallow holes, deep holes, inside splines, open-end holes gaged easily.
- Detects ovality, back or front taper, bell mouth, barrel shape.
- Reaches to bottom of blind holes.
- Gages work while still held in chuck.
- A shop tool for all-day every day use.
- Portable—no wires, hoses or stands.

Investigate the gage used by the thousands in jet engine, guided missile, farm machinery, automotive transmission, household appliance, and other volume-precision plants. IT MAKES PRECISION GAGING EASY . . . at machine . . . at inspection bench . . . for selective assembly. No other like it — investigate and see why.

COMTOR CO.
74 Farwell St.
Waltham 54,
Massachusetts

GET THE FULL FACTS — REQUEST BULLETIN 49

OPERATE HORIZONTAL MILLING MACHINES?

FREE DETAILS illustrate how Jergens Horizontal Milling Machine Bushing replaces bronze bushing in outer support–increases feeds and speeds up to 200% with minimized bushing wear, tool breakage, arbor wear, scoring and chatter. Revolutionary new concept allows utilization of carbide tools to full capacity on both new and old machines. Write for facts—today!

JERGENS DIVISION, DONLEY PRODUCTS, INC.
Dept. M-6, 11106 AVON AVE., CLEVELAND, OHIO

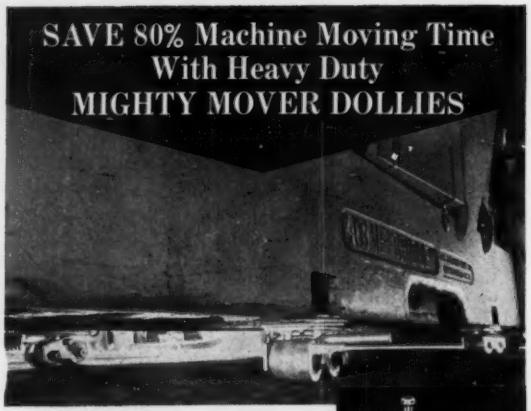
WHOOT MON!

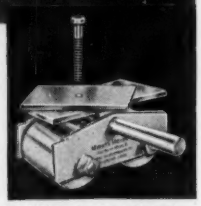
You really get your money's worth when you buy precision screw machine products made by "you know W.H.O.*"

CAP SCREWS • COUPLING BOLTS
SET SCREWS • MILLED STUDS
. . . our specialty.

Wm. H. Ottemiller Co. YORK, PENNA.

SAVE 80% Machine Moving Time With Heavy Duty MIGHTY MOVER DOLLIES





Eliminates Skids, Pipes, Winches and Cables

In all kinds of plants—every day—Mighty Mover heavy duty dollies are doing jobs faster, safer, and cheaper by eliminating moving crews using old fashioned, unsafe moving methods. Mighty Mover dollies permit 1 man to set up, move, spot bulky or heavy machines . . . in hours instead of days . . . and cut moving costs as much as 80%.

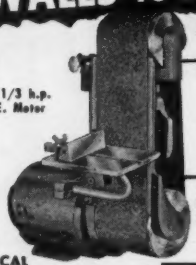
Nothing to wear out—nothing to maintain. Mighty Mover dollies have two 4-inch roller bearing cast iron wheels, tough side plates and a top plate that swivels 360 degrees. Each dollie weighs 40 lbs. Capacity: 100,000 lbs.

MIGHTY MOVER

MIGHTY MOVER COMPANY
1489 S. Milwaukee St. • Denver 10, Colo.

WALLS TU-WAY BELT SANDER

USE IT EITHER WAY



Full 1/3 h.p. G. E. Motor

HORIZONTAL

VERTICAL

At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use **$89.95**

Illustrated Literature on Request

A few desirable distributor territories still available.

WALLS SALES CORPORATION
333 Nassau Avenue Brooklyn 22, N. Y.

GEARS — ALL MAKES . . . Special and Standard

PRECISION GEARS UP TO 200 DIAMETRAL PITCH

All Gears certified for Accuracy Quality and Fine Workmanship

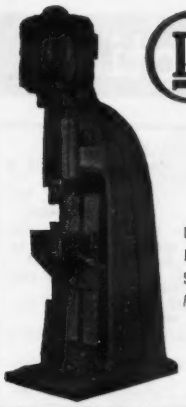
NEW JERSEY GEAR & MFG. CO.
1470 Chestnut Ave. **Hillside, N. J.**

RUSSELL HYDRAULIC SAWING MACHINES

all sizes up to 14" capacity, with or without automatic stock feed

Ask for catalogs

TRIPLEX MACHINE TOOL CORP.
75 West St. New York 6, N. Y.

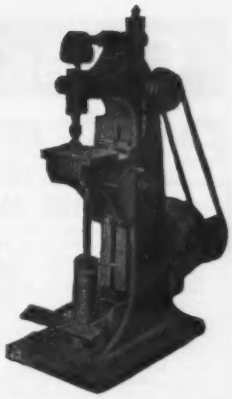


Noiseless Rivet Spinning Machines

GRANT PIONEERS IN RIVETING

OVER 50 YEARS' EXPERIENCE

BOTH SPINNER AND HAMMER TYPES
Single and Multiple Spindles—Vertical and Horizontal—Automatically or Foot-Operated. Handles rivets from the smallest and most delicate up to ¾" diameter.



Rotary Vibrating Riveters

THE GRANT MFG. & MACHINE CO.

N.W. Station **Bridgeport 5, Conn.**

Stahl's production facilities, skill and experience were responsible for the quick delivery of these bull and clutch gears. Intended for use in rubber machinery, they will provide the long-wearing, accurate performance characteristic of all Stahl-made gears—large or small. For your next gear needs contact Stahl.

SPURS TO 72" PD, 1 DP
BEVELS TO 54" PD, 1 DP
SPIRAL, HELICAL and WORM GEARS TO 48" PD, 2 DP
CONTINUOUS-TOOTH HERRINGBONE TO 60" PD, 2 DP
SPROCKETS TO 72" PD, 2½" CP
RACKS TO 20 FT. LONG, 3 DP
SILENT GEARS; RAWHIDE, BAKELITE, FIBROIL
HEAT-TREATED, CASE OR FLAME HARDENED GEARS—OF CARBON OR ALLOY STEEL

Stahl

GEAR & MACHINE COMPANY
3901 Hamilton Ave. Cleveland 14, Ohio

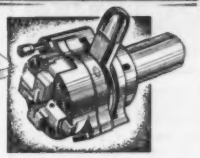
DAVIS KEYSEATERS

QUICK, LOW COST OPERATION is made possible by the Davis tilting table, which permits even work tapering as much as 3" per foot to be set up and cut quickly. And Davis multiple tooth cutters make quick work of all keyways up to 1" in width. Let us work out set-ups to speed up your production.

Write for Bulletin

DAVIS KEYSEATER COMPANY
405 EXCHANGE ST.
ROCHESTER 8, N. Y.

H&G Insert Chaser DIE HEADS



famous for accuracy and straightness of threads, low chaser costs, less downtime, more pieces per day.

THE EASTERN MACHINE SCREW CORP., 23-43 Barclay St., New Haven, Conn. Pacific Coast Representative: A. C. Behringer, Inc., 334 N. San Pedro St., Los Angeles, Calif. CANADA: F. F. Barber Machinery Company, Toronto.

EISLER ENGINEERING CO., INC. 736 SOUTH 13TH STREET NEWARK 3, N. J., U. S. A.

What every plant is looking for...

...the new all-purpose **SCRIPTA® PANTO-GRAVER**

ENGRAVES — nameplates, dials, panels, tools.
COPIES — diecasting moulds, embossing punches, etc.
CUTS — costs and time

Other models exist to solve every engraving problem. Write: SCRIPTA,® c/o this magazine or: W. F. WOLF MACHINERY Co. 2910 Santa Fe Avenue, Los Angeles, 58, Calif.

REG. U. S. PAT. OFF.

AGENTS REQUIRED FOR ALL 48 STATES

For more information fill in page number on Inquiry Card, on page 229

Classified and Re-Sale Section

eastern Rebuilt Machine Tools

THE SIGN OF QUALITY
THE MARK OF DEPENDABILITY

The listing below is only a VERY SMALL AMOUNT of the total number of machine tools that we have in stock for immediate shipment. Our prices are realistic with today's market and our quality of rebuilding is the same high standard—THE LEADER IN THE FIELD OF REBUILT MACHINE TOOLS

ENGINE LATHES

16"x30" centers Cincinnati, m.d.
16"x30" centers Monarch, m.d., taper
16"x8' bed Cisco Geared Head, m.d.
16"x8' Hendey Geared Head, m.d.
16"x6' Hendey Yoke Head, m.d., taper
16"x6' Lehmann Geared Head, m.d.
16"x6' Lodge & Shipley Selective Head, m.d.
16"x6' bed Monarch Geared Head, m.d.
17"x8' LeBlond Geared Head, m.d.
18"x42" centers Lodge & Shipley Geared Head, m.d.
18"x40" centers Monarch Geared Head, m.d.
18"x6' American, 3 speed
18"x3' LeBlond Geared Head, m.d.
18"x6'6" Greaves-Klusman Geared Head, m.d.
18"x8' bed American Geared Head, m.d.
18"x8' Hendey Geared Head, m.d., taper
18"x8' Lodge & Shipley Geared Head, m.d., taper
18"x8' Whitcomb-Blaisdell Geared Head, m.d.
18"x10'6" bed Boye & Emmes, cone, motorized
19"x8' bed LeBlond Geared Head, Timken, m.d.
19"x10' bed LeBlond Geared Head, m.d.
19"x36"x80" centers LeBlond Gap Lathe, m.d.
19"x18" LeBlond, m.d., late
20"x66" centers Hendey Geared Head, m.d., 1940
20"x48" centers Reed-Prentice Geared Head, m.d.
20"x48" centers LeBlond, m.d.
20"x72" centers Monarch Geared Head, m.d.
20"x8' bed Lodge & Shipley Geared Head, m.d.
20"x8' bed Greaves Klusman Geared Head, m.d., in leg
20"x8' bed Boye & Emmes, m.d.
20"x8' bed Cisco, cone, motorized
20"x12' bed, 7'10" centers American Geared Head, m.d.
20"x10' Sidney Geared Head, m.d.
20"x10'6" Boye & Emmes, cone, motorized
21"x8' bed LeBlond Geared Head, m.d., taper
23"x84" centers LeBlond Heavy Duty Geared Head, m.d.
24"x10' bed American, m.d.
24"x12' bed LeBlond Geared Head, m.d., taper
24"x12' bed Boye & Emmes, belt drive
24" raised to swing 32"x22' bed—16" centers—New Haven, cone, taper
24" Lodge & Shipley Lathe
26"x10' bed LeBlond Geared Head, m.d., taper
27"x28' bed Niles "Time Saver," m.d.
30" raised to swing 44"x15' bed American Geared Head, m.d.
30"x12'6" bed Niles-Bement-Pond variable speed, m.d., taper
30"x18' bed American High Duty Geared Head, m.d., taper
36"x24" centers American "Super-Productive," m.d.
36"x16'-5½" centers, 24' bed Lodge & Shipley Selective Head, m.d.
36"x16½' centers Lodge & Shipley Geared Head, m.d.
36"x18' bed Putnam Geared Head, m.d.
40" raised to 48½x108" centers LeBlond, m.d.
42"x14' bed American Geared Head, m.d.
42" Putnam raised to swing 56½x26' bed Geared Head, m.d., 11'8" centers
43"x32' centers Niles-Bement-Pond, m.d.
63"x7' centers I. W. Johnson, m.d.

MANUFACTURING LATHES

12x33", 20"x25", Jones & Lamson Fay Automatic Lathes, 1944
12x18" Reid Small Piece Production Lathe, Model 6WSL, m.d.
No. 3 Lodge & Shipley Duomatic, m.d., late type
No. 3A Lodge & Shipley Duomatic, m.d., late type
W. C. Lipe Carbo-Semi-Automatic, m.d., late
No. 4 LeBlond Boring Lathe, 37' bed, 4" hole, m.d., latest
No. 9, 12 LeBlond Multi-Cut, m.d
4x60" LoSwing, m.d.
8x132" LoSwing, m.d., latest
11x18" LeBlond Rapid Production, m.d.
12x18" centers Monarch Model 5T, m.d.
No. 12 Gisholt Semi-Special Automatic Production, m.d.
No. 9WSL, Reid Production Lathe
17"x39¾" LeBlond Mfg. Type Production Lathe
17"x75¾" centers LeBlond Rapid Production Lathe
No. 10 Sundstrand Automatic Lathe

HAND MILLING MACHINES

Vin Norman, m.d., latest

PLAIN MILLING MACHINES

No. 1B Milwaukee, m.d.
No. 2 Rockford, m.d.
No. 3B Brown & Sharpe, m.d.
No. 3B Milwaukee Plain, m.d.
No. 36 Van Norman Ram Type Swivel Head, m.d.
No. 3 Cincinnati Plain H.P., m.d.
No. 4 Cincinnati Plain H.P., m.d.

MANUFACTURING TYPE MILLING MACHINES

No. MM-1-6 U.S. Multi-Miller, m.d.
4" Pratt & Whitney Spline Miller, m.d.
18", 24" Cincinnati Plain Automatic, m.d.
24" Cincinnati Duplex Automatic, m.d.
No. 21 Brown & Sharpe Automatic, m.d.
42"x16' Newton Slab Miller, m.d.
42" Cincinnati Auto. Duplex Production Mill, m.d.
54"x30"x16' Ingersoll Slab Miller, m.d.
No. 1-18 Cincinnati Plain Automatic
No. 4-36" Cincinnati Plain Hydromatic, m.d.
No. 4-48" Cincinnati Tracer Controlled Duplex Hydromatic, m.d.
M80 Taylor & Fenn Duplex Spline Miller, m.d., latest type
Model 1402 Kearney & Trecker Simplex, m.d.
No. 23 Simplex Production Miller, m.d.
No. 33-1448 Sundstrand Rigidmill

PROFILERS

No. 12 Pratt & Whitney
No. 12M Morey, 2 spindle, 1944
4 spindle 360° Cincinnati Automatic, m.d., 1944

SLOTTERS

10" Newton, m.d.
12" Bement-Miles, m.d.
15" Canada, m.d.
18" Betts Crank Slotter, m.d.
18" Niles-Bement, a.p.d.
20-24" Dill, m.d.
22" Betts, m.d.
48" Niles Slotter, m.d.

PLANERS

P10 Cowiter Crank Type Shaper-Planer, 1 head, m.d.
30"x30"x10' Cincinnati, belted m.d., 2 heads
36"x36"x8' Cincinnati, m.d., 2 heads on rail
36"x36"x10' Betts, belted m.d., 2 heads on rail, 2 side heads
36"x36"x10' Niles-Bement-Pond, belted m.d., 1 head on cross rail
36"x36"x12' Betts, m.d., 2 heads
36"x36"x12' Gray, 3 heads
36"x36"x20' Cincinnati, 2 heads, belt
36"x36"x20' Gray Extra Heavy, belt, 2 heads on rail
36" widened to 42"x36"x10' Cincinnati, m.d., 2 rail heads, 1 side head
36"x36"x30' Cincinnati, m.d., 4 heads
42"x42"x26' G. A. Gray, 2 heads, belted motor drive
48"x48"x12' Cincinnati, 4 heads
48"x48"x18' Niles-Bement-Pond, 2 heads, belt
48"x48"x18' Detrick & Harvey, 4 heads, reversing m.d.
48"x48"x24' Cincinnati, riversing m.d., 4 heads
56"x42"x14' Cincinnati, belted m.d., 2 heads

The above is only a partial listing
WRITE FOR COMPLETE STOCK LISTING

THE EASTERN MACHINERY COMPANY
3666 Tennessee Avenue, Cincinnati 29, Ohio • MElrose 1241 • Cable Address EMCO

"LATE MODEL MACHINE TOOLS"

KELLER ENGRAVERS, (Seven) Model BL 3620 & BL3616 one, two & three spdl machines.
GRINDER, TOOL & CUTTER, No. 2 Cincinnati, late.
PLANER, 42" x 42" x 12' Liberty double housing
GRINDER, INTERNAL, No. 74 Heald hydraulic, late.
MULTIPLE DRILL, 16 spindle D-20-H Natco hydraulic 3" Dia. spdls., No. 5 M.T., new 1943.
GRINDERS, CYLINDRICAL, 10" x 18" Norton semi-automatic, plunge cut, new 1943.
GRINDERS, SURFACE, 13" x 60" Model 300 Hanchett vertical spindle, new about 1946.
AUTOMATIC, 1⅝"-6 spdl No. 61 New Britain chucker, serial 25230
GRINDERS, SURFACE, 72" No. 72 Hanchett rotary, new 1946.
SURFACE GRINDER, No. 1½ Abrasive, serial 786, late.
MILL, No. 2 Cincinnati plain horizontal, serial 4A2PIK17, late.
LATHE, 28" x 20" bed Lodge & Shipley engine lathe, 20 HP Drive unit.
MILL, No. 34-36 Cincinnati duplex mill, serial 3833DIH-4, late.
GRINDER, 4" x 12" Model 4H Landis plain cylindrical, new 1943.
LATHES, ENGINE, 14" x 6' bed Hendey toolroom. Timken, 1940.
LATHES, MFG., Model 10 Sundstrand automatic, front & rear slides, new 1942.
LATHES, TURRET, No. 3 Gisholt universal (2) late.
LATHES, TURRET, 36" and 42" Ballard New Era vertical.
PLANERS, 36" Rockford Hydraulic Openside Shaper-Planer, late type.

WRITE FOR ILLUSTRATED CATALOG OF 1000 MACHINE TOOLS

MILES MACHINERY COMPANY
2045 E. Genesee Ave.
Telephone—Saginaw 2-3105
SAGINAW, MICHIGAN

ADVERTISING MAN WANTED FOR TECHNICAL PRODUCTS: Previous advertising experience not necessary but helpful. Must have at least two or three years of college with courses in engineering and technical subjects and like to write. If you have the qualifications we have an opportunity open for you. Man selected will be trained in all phases of industrial advertising. In your letter of application state age, education, positions held, and give statement of why you want a career in advertising. Location: well-known Connecticut company. Write Box 705, Machinery, 93 Worth St., New York 13, N. Y.

ENGLISH PRECISION ENGINEERING CO. OF LIGHT/MEDIUM CAPACITY

desires to contact an American Concern with a view to building their equipment under License for sale in the European Market.

Would prefer to build a machine of approved design having an established American Market, but will consider a machine having no established market, provided it is of unique design, giving it good sales potential. Representative Director, Mr. Wm. Brett, will be in the U.S. during June. Any correspondence, etc., addressed to him c/o Bank of America, New York, will have attention. Canterbury Engineering & Precision Works Ltd., Wincheap, Canterbury, Kent.

MACHINE TOOLS

24" x 12' Boye & Emmes Geared Head Engine Lathe. 5'6' Centers, Taper attachment, Timken Precision Taper Roller Bearing Spindle. Rebuilt and Guaranteed. Late Type.

FALK MACHINERY CO.
19 Ward Street — BA 5887 — Rochester, N. Y.

"Key to Preventive Maintenance"

MACHINE TOOL RECONDITIONING

& the Art of Hand Scraping (new 2nd printing) —useful for design, shop & inspection work— Write for folder describing illustrated book.

MACHINE TOOL PUBLICATIONS
215 Commerce Bldg. South Wabash St.
St. Paul 1, Minn.

• Are there any machines or equipment you need, or would like to sell? Advertisements in MACHINERY'S Classified and Re-Sale Section bring results! Rates are $12.00 per single-column inch. Send payment with order. MACHINERY, 93 Worth Street, New York 13, N. Y.

Wanted lines for representation in the Detroit area. Have 15 years experience, with good contacts in the automotive field and other major industries. Write Box 706, Machinery, 93 Worth St., New York 13, N.Y.

MALE HELP WANTED

Design Engineer, preferably graduate M.E. with experience on medium size and special machinery. Location upstate New York. Excellent opportunity for rapid advancement. A. J. Wahl, Inc., 8 Central Ave., Brocton, N. Y.

AT AUCTION

To the Highest Bidders

500 Machine Tools • 1000 Tons Steel

Excess to the Consolidation Program of the Eddystone Division of

BALDWIN-LIMA-HAMILTON CORPORATION

Eddystone, Pa.

TUESDAY and WEDNESDAY, JUNE 26 and 27, 1956

at 10 A. M. (dst) Each Day on the Premises

Baldwin-Lima-Hamilton Corporation is consolidating the operations of its Eddystone Division into the Southwark Plant and certain machine tools and steel are excess to its present needs. The excess Real Estate has been sold, therefore immediate removal of the tools and steel is necessary.

STEEL—Approx. 1000 Tons Cold Roll Bars, Flats, Squares, Sheets, Angles, Channels, Tees, Zees, etc. Alloy Plate, Spring Steel, Ground Steel and Aluminum Sheets and Bars, assorted.

48 DRILL PRESSES—24 Upright 1 to 6 Spindle, 12" to 28" Swing; 24 Radial Drills 3' to 6' Arms, 9" to 15" Columns.

26 MILLING MACHINES—Plain, Universal, Vertical and Slab.

86 LATHES—16 Turret Lathes, 6 Portable, 2½" to 3½" Capacity, 10¼" to 22" Swing; 10 Vertical Turret Lathes, 24" to 50" Tables; 60 Geared Head, Quick Change, Back Geared, Heavy Duty and Precision Toolroom and Engine Lathes, 16" x 54" to 48" x 22' Centers.

14 SHAPERS—Crank, Radius and Duplex, 14" to 32".

8 VERTICAL SLOTTERS—20" - 22" Stroke, 24" - 34" Tables.

23 THREADING MACHINES—2 and 4 Head, 1" to 8" Capacity.

44 PLANERS—3 and 4 Head, 36" x 36" x 10' to 64" x 72" x 21'.

48 BORING MILLS—30 Horizontal 2½" to 8"; 18 Vertical 42" to 72" Tables.

47 GRINDERS—5 Plain Cylindrical 10" x 72" to 16" x 120"; 42 Internal, Cylindrical, Surface, Cutter and Tool Bench and Pedestal Grinders.

SAWS—Hydraulic Universal Roll Stroke Hack Saw; Grab and Doall Job Selectors; Contour Band Sawing and Filing Saws; Cold Saw; Power Hack Saws.

7 AUTOMATIC SCREW MACHINES—1 to 4 Spindle, ⅛" to 4" Capacity.

2 POWER PRESS BRAKES—8' and 10'.

8 POWER SHEARS—1 Alligator, 30" Blade, Capacity 8" x 8" Billets, Gear and Motor Drive; 7 Rod Bar and Squaring Shears, Assorted.

FORGING MACHINES—9 Horizontal Forging Machines, ¾" to 5"; 17 Straight Side Power Trimming Presses, 10 to 500 Tons; 20 Steam Drop Hammers, 800 to 4500 Tons, 7 Horizontal Hydraulic Forging Presses, 20 to 350 Tons; 3 Hydraulic Throat Shears, 10"-18".

FOUNDRY EQUIPMENT—8 Drying and Core Ovens; 2 Sand Mullers; Sand Handling Unit; Swing Hammer Pulverizer; 4 Horizontal Sand Mixers; 3 Whiting Cupolas; 2 Rotary Pressure Blowers; 2 Vibrex Coke Screens; 2 Tumblast Wheelabrators.

MISCELLANEOUS—Engine and Locomotive Parts, Tractors, Auto Trucks, Bull Dozers, Locomotive Crane, Locomotives, Gondola and other Cars, Industrial Trucks, Varied Machinery and Factory Equipment.

Write for Descriptive Illustrated Brochure

SAMUEL T. FREEMAN & CO.

Auctioneers

"Over a century and a half of selling at auction"

1808-10 CHESTNUT STREET, PHILADELPHIA 3, PA.

80 FEDERAL STREET, BOSTON 10, MASS.

Designed to do one job in the best possible way.....

LELAND-GIFFORD *Special* DRILLING MACHINES

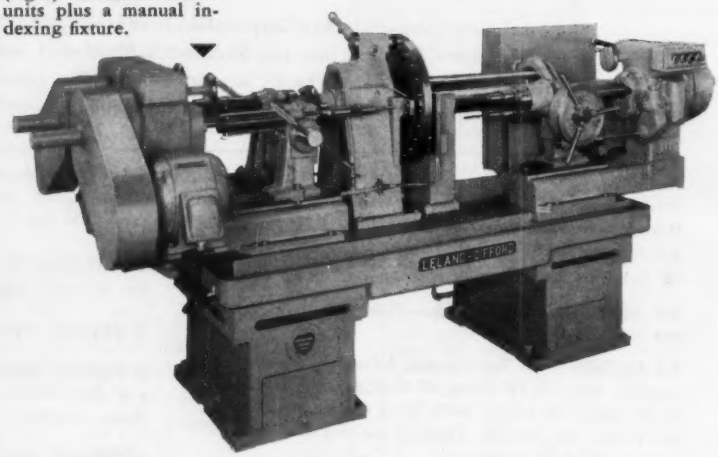
Contact the office nearest you for help with your drilling problems.

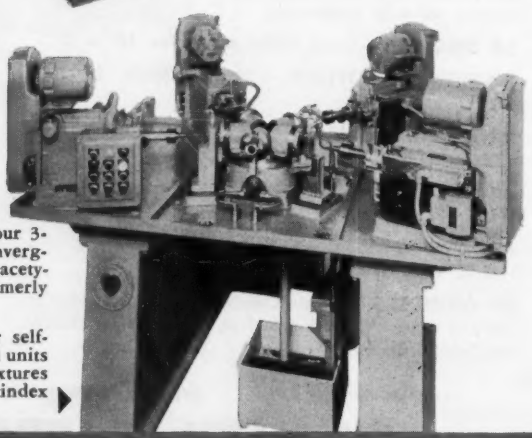
THE JOB — Drill two .630 x 3¾" x 25° holes in 4-cylinder and 6-cylinder crankcases.

THE SETUP — A No. 3 self-contained step feed unit with 2-spindle head, special base cabinet with roller-type fixture, plus angular top column. Ties into conveyor line to eliminate lifting.

THE JOB — Drill and ream 48 holes (tap and countersink 24) in an aircraft turbine shaft.

THE SETUP — Two single (left) and one 2-spindle (right) horizontal V-belt units plus a manual indexing fixture.





THE JOB — Drill four 3-diameter deep converging holes in copper acetylene torch tips. Formerly a hand operation.

THE SETUP — Four self-contained step feed units plus five holding fixtures and a hydraulic index table.

LELAND-GIFFORD
Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.

CHICAGO 43
2515 West Peterson Ave.
DETROIT
10429 West McNichols Rd.
CLEVELAND 22
P.O. Box 853
NEW YORK OFFICE
75 South Orange Ave.
South Orange, N. J.
LOS ANGELES OFFICE
2620 Leonis Blvd.
Vernon 58, Cal.
INDIANAPOLIS 6, P. O. Box 1051
ROCHESTER 12, P. O. Box 24, Charlotte Station

For more information fill in page number on Inquiry Card, on page 229

ALPHABETICAL INDEX OF ADVERTISERS

A

Abbey Etna Co. 245
Allegheny Ludlum Steel Corp. 104
Allen-Bradley Co. 312-351
Allen Manufacturing Co. 52
Amelco, Inc. 362
American Brass Co. 51
American Broach & Mch. Co. ..... Insert 77-92
American Chain & Cable 288
American Schiess Corp. 331
American Sip Corp. 69
American Tool Works Co. 117
Armstrong-Blum Mfg. Co. 20
Armstrong Bros. Tool Co. 128
Austin Industrial Corp. 126
Automotive Gear Works, Inc. 313
Axelson Manufacturing Co., Division U. S. Industries, Inc. 131

B

Baker Brothers, Inc. 355
Baldwin-Lima-Hamilton Corp., Hamilton Div. 323
Barber-Colman Co. Insert 77-92
Bardons & Oliver Inc. 325
Barnes Drill Co. 77-92
Barnes, W. F., John Co. 77-92
Bethlehem Steel Co. 98-107
Birdsboro Steel Foundry & Mch. Co. 309
Blanchard Machine Co. 75
Bodine Corporation 271
Boston Gear Works 32
Brad-Foote Gear Works, Inc. 306
Bridgeport Brass Co. 223
Bridgeport Machines, Inc. 116
Brown & Sharpe Mfg. Co. 216-217
Bryant Chucking Grinder Co. 260-261
Buffalo Forge Co. 60-61
Buhr Machine Tool Co. 40-41
Bullard Co. ..... Insert 73
Bunting Brass & Bronze Co. 290
Burg Tool Mfg. Co. 335

C

Carboloy Dept. of General Electric Co. 93-94-95-96
Carpenter Steel Co. 100
Chicago Pneumatic Tool Co. 278-279
Cincinnati Bickford Tool Co. 219
Cincinnati Gear Co. 322
Cincinnati Milling Machine Co. 6-7
Cincinnati Milling Products Process Machinery Div. .. 247
Cincinnati Shaper Co. 62-63
Cities Service Oil Co. 121
Classified Advts. 366-367
Clearing Machine Corp., Div. U. S. Industries Inc. 264-265
Cleveland Automatic Machine Co. 357
Cleveland Crane & Engrg. Co. 44
Cleveland Punch & Shear Wks. Co. 345
Cleveland Twist Drill Co. Insert bet. 44-45
Cleveland Worm & Gear Co. Inside Back Cover
Climax Molybdenum Co. 103-105
Colonial Broach & Machine Co. 314
Columbus Die-Tool & Mch. Co. 283
Comtor Co. 364
Cone Automatic Mch. Co., Inc. 129
Consolidated Machine Tool Co. 38-39
Crane Packing Co. 134
Cross Company 132-133
Crucible Steel Co. of America 97-99
Cumberland Steel Co. 102

D

Danly Mach. Specialties, Inc. 109
Davis & Thompson Co. 310
Davis Keyseater Co. 365
DeLaval Separator Co. 42
Denison Engineering Co. 259
Diefendorf Gear Corp. 362
DoAll Company 262-263
Donley Products Inc., Jergens Div. 364
Dreis & Krump Mfg. Co. 363
du Mont Corporation 358
Dykem Co. 362

E

Eastern Mch. Screw Corp. .. 365
Eastman Kodak Co. 299
Edlund Machinery Co. 311
Eisler Engineering Co., Inc. 365
Espen-Lucas Machine Works 297
Ettco Tool Co. 44-A
Ex-Cell-O Corp. 235-251

F

Fafnir Bearing Co. 233
Farquhar, A. B. Div., The Oliver Corp. 266-267
Federal Products Corp. .. 112-113
Fellows Gear Shaper 4-5
Ferracute Machine Co. 338
Fiske Brothers Refining Co. 348
Foote-Burt Company 28
Fraunenthal Div., Kaydon Engrg. Corp. 66-67
Freeman, Samuel, T. & Co. 367

G

Gallmeyer & Livingston Co. 326
Gardner Machine Co. 21-37
Gear Specialties, Inc. 225
General Electric Co. Insert bet. 75-76
Giddings & Lewis Machine Tool Co. 22-23
Gisholt Machine Co. Insert pages 33-36
Gits Bros. Mfg. Co. 293
Gleason Works 115
Gorton, George, Machine Co. 341
Goss & DeLeeuw Mch. Co. .. 308
Grant Mfg. & Machine Co. .. 365
Gray, G. A., Co. 31
Greenlee Bros. & Co. Insert 77-92

H

Hamilton Tool Co. 318-319
Hannifin Corporation 315-346
Hardinge Brothers, Inc. 138
Hartford Special Machinery Co. 332
Haynes Stellite Div., Union Carbide & Carbon Corp. .. 106
Heald Machine Co., The Inside Front Cover
Heller Tool Co. 317
Hoern & Dilts Div., New Britain Machine Co., The 46-47
Holcroft & Co. 292
Horton Chuck Co. 130
Howell Electric Motors Co. 339
Hunt, C. B. & Son, Inc. 280
Hydraulic Press Mfg. Co. .. 48-49

I

Illinois Gear & Machine Co. 291
Industrial Filtration Co. 316
Ingersoll-Rand Co. 300-301
International Chemical Co. .. 336

J

Jacobs Manufacturing Co. Front Cover
Jergens Tool Specialty Co. .. 363
Johnson Manufacturing Corp. 328
Jones & Lamson Machine Co. ..... Insert 54-55, 43

K

Kearney & Trecker Corp. .. 16-17
Kennametal, Inc. 285, 347

L

Lake Erie Engineering Corp. 295-296
Landis Machine Co. 2-3
Landis Tool Co. 10-11
Lapmaster Div., Crane Packing Co. 134
LeBlond, R. K., Machine Tool Co. 268-269
Lees-Bradner Co. 275
Leland-Gifford Co. 368
Lincoln Electric Co. 257
Linde Air Products Co., Div. Union Carbide and Carbon Corp. 74
Lodge & Shipley Co., The .. 327
Lubriplate Div., Fiske Bros. Refining Co. 348

M

Madison-Kipp Corp. 239
Marvel Engineering Co. 284
Materials Section 93-108
Mattison Machine Works .. 77-92
McCrosky Tool Corp. 304
Metal Carbides Corp. 307
Michigan Drill Head Co. 330
Micromatic Hone Corp. 329
Micro-Positioner Corp. 349
Mighty Mover Co. 364
Millholland, W. K., Machinery Co., Inc. 294
Mitts & Merrill 363
Monarch Machine Tool Co. 254-255
Morris Machine Tool Co. 272-273
Motch & Merryweather Mchry. Co. 305
Mummert-Dixon Co. 362

N

National Acme Co. 29-30
National Automatic Tool Co. 286-287
National Broach & Mch. Co. 45
New Britain Machine Co., The ..... 46-47, 64-65, Insert bet. 64-65
New Departure, Div. General Motors 289
New Jersey Gear & Mfg. Co. 364
New Jersey Zinc Co. 227
Niagara Machine & Tool Works 18-19
Nice Ball Bearing Co. 333
Norton Company 14-15, 58-59

O

Oakite Products, Inc. 101
Ohio Crankshaft Co. 125
Oilgear Co. 111
Oliver Instrument Co. 320
Orange Roller Bearing Co. Inc. 110
Orban, Kurt, Co., Inc. 331
Osborn Mfg. Co. 359
Ottemiller, Wm. H., Co. 364

P

Pangborn Corporation 370
Parker-Kalon Div., General American Transportation Corp. 337
Philadelphia Gear Works, Inc. 53
Pope Machinery Corp. 237
Precision Tool & Manufacturing Co. of Illinois 344
Producto Machine Co. 303

ALPHABETICAL INDEX OF ADVERTISERS

R

Rehnberg-Jacobson Mfg. Co. Insert 77-92
Reliance Electric and Eng. Co. 277
Revere Copper & Brass, Inc. 243
Rockford Clutch Div. of Borg-Warner 334
Rockford Machine Tool Co. Insert 77-92
Rowbottom Machine Co. 352
Russell, Burdsall & Ward Bolt & Nut Co. 228
Russell, Holbrook & Henderson, Inc. 123
Ruthman Machinery Co. 360
Ryerson, Joseph T. & Son, Inc. 140

S

Scherr, George, Co., Inc. 362
Schrader's A., Son, Div. Scovill Mfg. Co., Inc. 321
Scripta 365
Scully-Jones & Co. 68
Seneca Falls Mch. Co. 71
Sheffield Corp. 127
Sheldon Machine Co., Inc. .. 298
Shell Oil Co. 70
Shenango-Penn Mold Co. 302
Shore Instrument & Mfg. Co., Inc. 363
Sidney Machine Tool Co. 221
Simonds Saw & Steel Co. 57
Snyder Tool & Engrg. Co. 26-27
Socony Mobil Co., Inc. 124
South Bend Lathe Works 354
Stahl Gear & Machine Co. 365
Standard Electrical Tool Co. 324
Standard Gage Co., Inc. 76
Standard Oil Co. (Indiana) 281
Standard Pressed Steel Co. .. 56
Stuart, D. A., Oil Co., Ltd. 270
Sun Oil Co. 253
Sundstrand Machine Tool Co. ..... Insert 77-92
Super Tool Co. 135

T

Texas Company 136
Threadwell Tap & Die Co. .. 361
Thriftmaster Products Corp. 363
Timken Roller Bearing Co. Back Cover
Timken Roller Bearing Co. Steel & Tube Div. 108
Tomkins-Johnson Co. 343
Triplex Machine Tool Corp. 364

U

U. S. Burke Machine Tool Div. 118
U. S. Tool Company, Inc. 12-13
Union Carbide & Carbon Corp., Haynes Stellite Co. 106
Union Carbide & Carbon Corp., Linde Air Products Co., Div. 74
United States Steel Corp. .. 122
Universal Engineering Co. .. 119
Used Machinery 366-367

V

Vanadium-Alloys Steel Co. .. 248
Van Norman Co. 8-9
Verson Allsteel Press Co. 120
Vickers, Inc. 114
Viking Pump Co. 356
Virginia Gear & Machine Co. 53

W

Waldes Kohinoor, Inc. 241
Wales-Strippet Corp. 283
Walker, O. S., Co., Inc. 274
Walls Sales Corp. 364
Warner & Swasey Co. 24-25
Wesson Company Insert bet. 124-125
Whitman & Barnes, Inc. ... 276
Wicaco Machine Corp. 353
Wilson, K. R., Inc. 282
Wilson Mechanical Instrument Div., American Chain & Cable 288
Wood, R. D., Co. 50

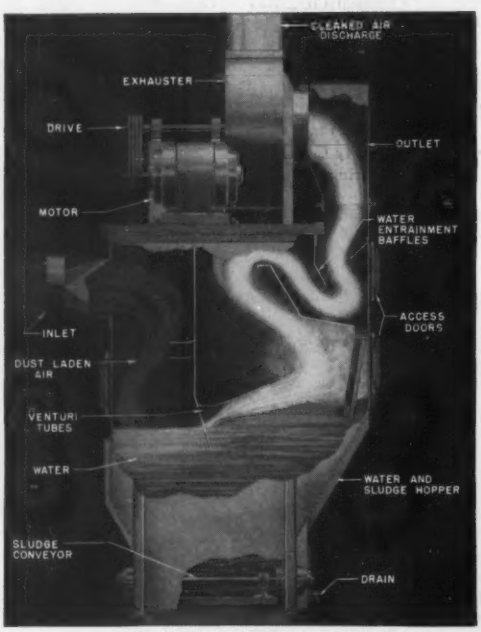
Y

Yoder Co. 72

Z

Zagar, Inc. 342

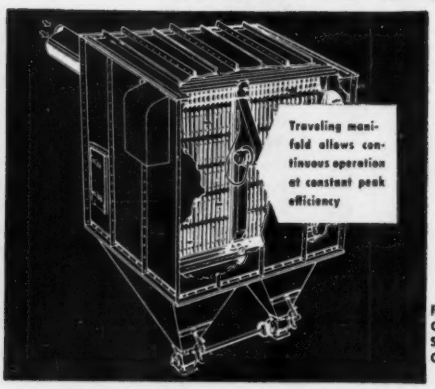
NOW—Great news about two new Pangborn Dust Collectors!



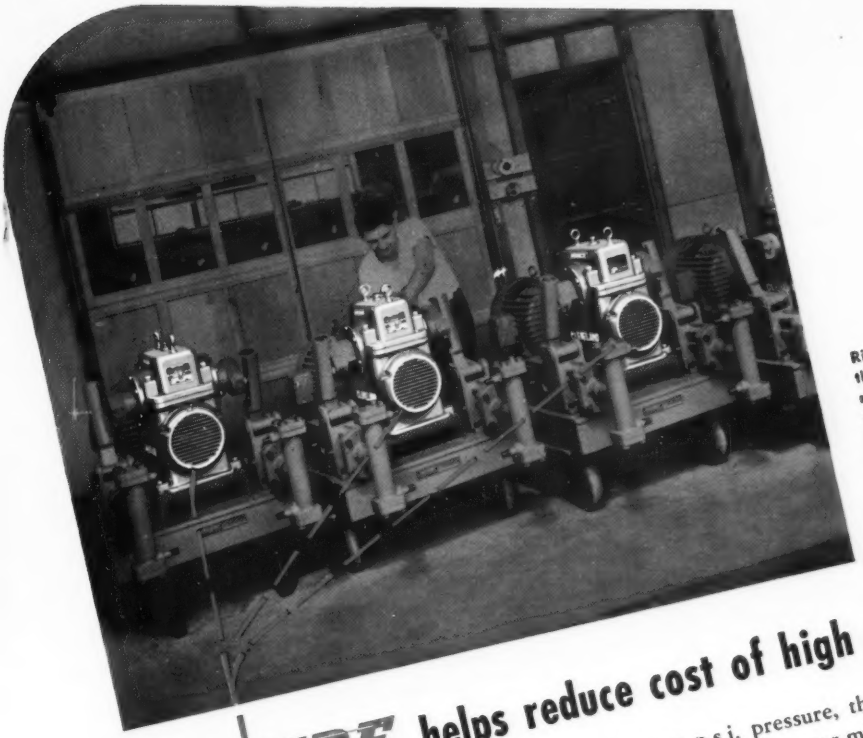
PANGBORN VENTRIJET WET COLLECTOR

These two new developments in industrial dust control by Pangborn are designed to handle any dust problem! The new Pangborn Self-Cleaning Collector utilizes a traveling reverse air manifold for continuous operation at constant peak efficiency. Use the new Pangborn Ventrijet for effective control of dusts a dry collector cannot handle! For complete information, write to: PANGBORN CORPORATION, 1200 Pangborn Boulevard., Hagerstown, Maryland.

Pangborn CONTROLS DUST



PANGBORN CONTINUOUS SELF-CLEANING COLLECTOR



Right off the assembly line, these Philadelphia Pumps are ready for action. Driven by Speedaire . . . these rugged, heavy-duty pumps are assured of a sturdy power source.

SPEEDAIRE helps reduce cost of high pressure pump

DESIGNED to operate at 3,000 p.s.i. pressure, this 50% metal slurry pump delivers 3 gallons per minute. Built to handle tough, unusual jobs, it is driven by a tough, unusual speed reducer—the Cleveland Speedaire. Not only did Speedaire offer the smaller frame size needed for this unit, it also helped substantially to reduce its price. Speedaire costs hundreds of dollars less than a conventional drive of comparable capacity.

Further, the fan-cooled Speedaire worm gear reducer runs cool and smoothly under a heavy load, unaffected by heat, moisture and grime. Thousands are in service. Chances are you can use one or more right now! If you aren't familiar with Speedaire, just call us. Ask for a copy of Catalog 400. The Cleveland Worm and Gear Co., 3276 East 80th St., Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

CLEVELAND
Worm Gear
Speed Reducers

How you can profit from a nation-wide search for accuracy

SCIENTISTS at the Massachusetts Institute of Technology were stymied on a top secret National Defense project. Some extremely accurate plug and ring gages were needed, but where to find a manufacturer capable of tackling an order calling for such extreme accuracy was the problem. The search eventually led to The Timken Roller Bearing Company. The M.I.T. engineers came to our Canton, Ohio, plant, were impressed with our gage facilities and our gage laboratory—acknowledged as one of U. S. industry's finest—and asked if we would help them out.

Ordinarily we do not make gages for anyone's use other than our own, but because this was an important National Defense project, we agreed to make them. And we did.

To make the finest roller bearings we need the most accurate gages. Our fine gage laboratory is one of the reasons that Timken® tapered roller bearings are considered to be the world's best.

So if you're looking for accuracy in the machines you build or buy, look to Timken tapered roller bearings. They practically eliminate friction, take any combination of radial and thrust loads, insure lasting precision. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF

TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭

BEARING TAKES RADIAL ↓ AND THRUST →—LOADS OR ANY COMBINATION→